

GARBAGE

THE INDEPENDENT ENVIRONMENTAL QUARTERLY

garbage



the
‘silent killer’?

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New in this Issue

JOINING SUCH VENERABLE PUBLICATIONS as *Consumer Reports*, *Ms.*, and *MAD* magazine (as well as many academic journals), *GARBAGE* has dropped all paid advertising from its pages. We had several reasons to do so, not the least of which were the changing definition of the "green marketplace" and the pursuit of complete editorial independence.

I want to make clear that we never experienced advertiser interference with editorial. Never. By independence, I mean the freedom for editorial coverage to evolve without the pressure of serving a predetermined market.

You'll note that the entire magazine is now devoted to editorial material. We've added an opinion column (**Soapbox**, p. 58) and included short authors' biographies with summaries of their articles

(**At Issue**, p. 19). The new **Letters** section (p. 6) is slightly expanded in response to the level of debate going on there.

GARBAGE has moved to quarterly frequency,

giving editors and contributors longer lead times. Although many ad-free journals and quarterlies are graphically simple, we decided not to compromise on color, photos, or illustrations. Our award-winning design has been complimented and appreciated by readers; we think it enhances editorial in what is often a dour field.

We do want you to pay more for a subscription. The basic rate this year is \$39. [Call 800-274-9909 to renew or start a subscription.] Large-volume direct mail is expensive and unrewarding for specialty magazines, so we rely on you to pass the word. If you'd like to give a courtesy subscription to a colleague, call the number above. For information on multiple subs or discounted bulk copies, call Cathie Hull at (508) 281-8803. Despite the ravings of our more paranoid readers,

GARBAGE is not secretly financed by any industrial consortium. Your support is thoroughly appreciated. We'll continue to do our best.



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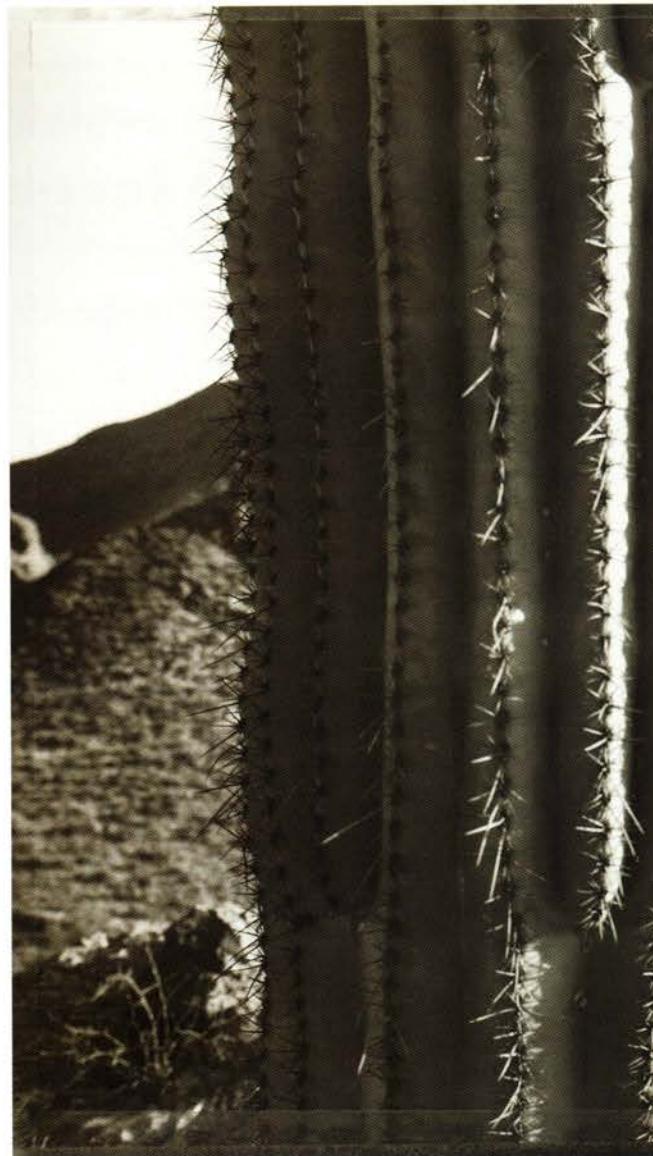
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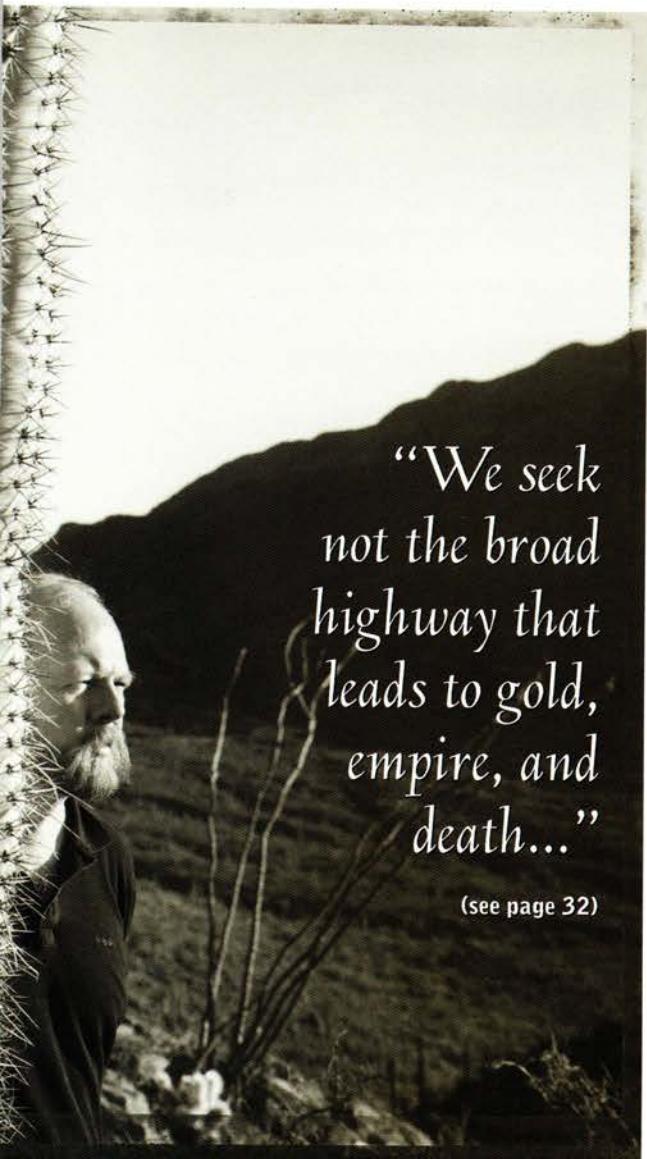
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review noteworthy stories from the last quarter. Also, news briefs and article updates.



LETTERS TO THE EDITOR

OZONE: SCAM OR CRISIS?

September/October 1993

GARBAGE HAS FALLEN PREY TO THE most common fallacy of so-called objective journalism: that the truth about any controversy can be found by splitting the difference between the diametrically opposed views of the "extremes." This know-nothing logic assumes both sides are motivated by the same degree of self-interest, cynicism, and disregard for the facts.

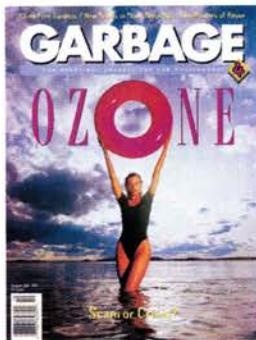
But consider: If DuPont and its apologists in "Camp Hogwash" can convince the public, press, and elected officials that CFCs and HCFCs are relatively harmless, a huge corporation gets to keep making products that earn them millions of dollars a year. If Greenpeace wins a ban on chlorinated chemicals — which not only destroy the ozone layer but are also potent toxic poisons — we will be acting prudently in the face of mounting, if not yet definitive, evidence. The environmentalists' approach is called the precautionary principle; DuPont's is a willingness to risk lives for profit.

Coming soon in GARBAGE: Dioxin: A Little Dab'll Do Ya, Defense of Clearcuts, and Nuclear Power: No Fatal Accidents Since Chernobyl.

— MELANIE DUCHIN
Greenpeace Ozone Campaign
San Francisco

.....

The Editors respond: It is widely assumed that DuPont and the rest of the halocarbon industry will make huge profits from the CFC phaseout, as they will develop the patents on substitutes.



YOU ARE TO BE GREATLY COMPLIMENTED for your even-handed review of the ozone hole problem.

However, you have incorrectly put me in "Camp Hogwash," by default perhaps, since you list no other camp differing with "Camp Apocalypse." I have used none of the five arguments attributed to "Camp Hogwash," although I wouldn't object strenuously to argument (5) [pertaining to the unknown relationship between stratospheric ozone concentration and UV-B at ground level].

My main arguments against "Camp Apocalypse" from the very beginning in the early 1970s has been their studious ignoring, if not actual denial, of the beneficial effects of UV and of its huge variations with latitude. From the poles to the equator it increases about 50-fold in the annual mean and about 10-fold in the summer midday max. A 1% increase in skin cancer incidence over the U.S. is equivalent to moving about 6 miles toward the equator.

I have been trying in vain for 20 years to get "Camp Apocalypse" to give the latitudinal displacement equivalents of the ozone decreases they have been predicting so that the general public could evaluate their seriousness for themselves. Can you think of any reason why they wouldn't want to do this?

— HUGH W. ELLSAESSER
Ph.D., Meteorology
Livermore, Calif.

Dr. Ellsaesser retired from the U.S. Air Force after 20 years as an Air Weather Officer and from the Lawrence Livermore National Laboratory after 23 years in atmosphere and climate research.

OZONE COVER

September/October 1993

I greatly enjoyed your swimsuit issue. Personally, I never have understood how hairy legs and Birkenstocks help save the planet!

Keep up the good work. GARBAGE is probably the most informative, thought-provoking and also entertaining environmental publication I have ever read. Who says environmentalism has to be all gloom-and-doom?

— MICHAEL ARROWOOD
Zirconia, N. Carolina

I commend your investigative approach toward environmental issues. I do, however, take offense to the cover. I fail to see the constructive purpose in featuring a scantily clad woman. It is no longer acceptable in contemporary society to gratuitously expose a person's body. To do so is to objectify and hence demean the value and worth of the person as a whole.

— SAMANTHA MANNE
Nepean, Ontario

Patricia Poore responds: Dr. Ellsaesser, no! We didn't and don't put you in a "camp." Nor did we place Dobson, Rowland and Molina, Teramura, Singer, et al. in either camp. The Camps get the media attention, and so public access. We realize, and tried to point out, that most scientists work in a complex and evolving "middle ground" between the political extremes.

I AM IMPRESSED. THE OZONE ARTICLE, which contains some reference to me, is fair, on balance surprisingly neutral and commendably skeptical. This is very refreshing since I believe that many scientists, including others who,

like me, have spoken out on this topic, are not nearly so rigid in their position as the popular press often presents.

Having expressed my overall favorable reaction, there are a few items that warrant comment.

The ozone hole. Whether Dr. Gordon Dobson "discovered the Antarctic ozone hole" in 1956-1957 during the International Geophysical Year will doubtless continue to be contested. However, his student and collaborator at that time, Dr. Marcel Nicolet, recently stated on Belgian national television in a documentary entitled "Fair Skin, Stay In" (September 18, 1992, available on videotape) that Dr. Dobson discarded his lowest measurements before publication because "... nobody would believe them."

Moreover, the French investigators P. Rigaud and B. Leroy also working in Antarctica during the I.G.Y., reported from the French Observatory at Dumont d'Urville the lowest ozone level ever recorded: 110 Dobson units in 1958. Their results have been challenged, and so they reexamined and recalculated all their data. They stand by their earlier report, 110 Dobson units, as they published once more in 1990. (*Annales Geophysicae*, Vol. 8, No. 11, pp. 791-794).

Can CFCs migrate to the stratosphere? The important question is not whether some few CFC molecules may reach the stratosphere, but whether there are enough of them to cause the amount of ozone destruction claimed. CFC molecules have indeed been detected, but only from ground-based measurements, and at a concentration of about 200 parts per trillion at a height of 20 kilometers, declining to less than 10 parts per trillion at 30 km. According to research reported by Dr. D.B.

[The Ozone discussion continues on p.64.]

GETTING THE LEAD OUT

November/December 1993

YOUR ARTICLE WAS VERY INFORMATIVE. However, I am afraid that its presentation of the risks posed by lead may have been more alarming than justified by the facts. It is certainly true that lead exposure can have a devastating impact on children's intellectual development. The question is at what level. While the CDC maintains that lead is harmful at lead levels of 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$) in the bloodstream, its European equivalents would

not agree. As British lead expert Dr. Marjorie Smith has written: "It is still not possible to conclude with any certainty that lead at low levels is affecting the performance or the behavior of children." The only scientific consensus is on the negative effects of lead at levels above 20 $\mu\text{g}/\text{dL}$.

More significantly, the article failed to put the discussion of lead risks in perspective, both historically and in relation to other risks. Due to the removal of lead from paint and gasoline, lead levels have been declining for decades. In the 1970s average blood lead levels were well above the CDC action level of 10 $\mu\text{g}/\text{dL}$. Whereas average blood lead levels were above 20 $\mu\text{g}/\text{dL}$ in the 1960s, today the average is below 5 $\mu\text{g}/\text{dL}$. Are we to believe that the average child growing up 20 years ago was suffering from lead poisoning? The article also fails to point out that lead poisoning rates are significantly lower in Western states due to a relatively newer housing stock. The primary battles in the war against lead poisoning have been won,



and it is now appropriate to focus America's scarce resources on greater threats to our children's health.

Finally, I would caution those who are interested in the lead issue against relying too heavily on the work of Dr. Herbert Needleman, chairman of the board of the Alliance to End Childhood Lead Poisoning, a Washington, D.C.-based advocacy group. While his early work was responsible for raising the awareness of the negative effects of lead, his research has also come under scrutiny for potential scientific misconduct. A review panel that convened

at the University of Pittsburgh to investigate the charges concluded that his explanation of his research methods revealed "a pattern of errors, omissions, contradictions, and incomplete information from the original publication to the present" though the panel stopped short of charging Needleman with deliberate misconduct. Without Dr. Needleman's research, it is difficult to maintain many of the premises upon which the current lead hysteria is based. Lead is a real concern, but journalists should be careful not blow its risks out of proportion.

—JONATHAN H. ADLER,
Environmental Policy Analyst
Competitive Enterprise Institute
Washington, D.C.

Dr. Needleman responds:

[Jonathan] Adler's criticism of your article "Getting the Lead Out," on the national scientific consensus on lead's toxicity, and of my work, relies not on scientific data, but on selective quotation of secondary sources. He quotes Marjorie [continued on next page]

Smith, whose single piece of research on lead and children's IQ was published 12 years ago. When her data was reanalyzed by her colleague Stewart Pocock, a clear effect of lead on IQ in males was reported.¹ This was ignored by Adler.

He states that average blood lead levels in the 1970s were well above 20 µg/dL. He is wrong. There is not one authoritative piece of evidence to that point. He notes the real decline in blood lead levels over the past decade (due in large measure to the removal of lead from gasoline) and asks the reader whether they believe that people in the past who had blood lead levels above 20 µg/dL were poisoned. Any scientist or fair reporter would trouble to look at the data. He would find a wealth of good studies in humans and in experimental animals that show effects of lead on central nervous system function at levels well below 20 µg/dL. These studies have caused the Centers for the Disease Control, the Agency for Toxic Substances and Disease Registry, the American Academy of Pediatrics, and the EPA all to agree that lead at levels of 10 µg/dL is neurotoxic.

This data base is too formidable for Adler to attack, so he selects one sentence from a Hearing Board Report. This Board was convened because two lead industry consultants accused me of scientific misconduct. The Hearing Board found no evidence to support these charges:

The Hearing Board find that there was no fabrication on the part of Dr. Needleman in the conduct of his research. What is particularly important is that we found no evidence of deliberate falsification of data, procedures or analysis that would bias the results in favor of finding a harmful effect for lead on the neuropsychological development of young children. The Board also

finds that the data file which Dr. Needleman has shared with us and others contains the primary data available for the 270 children for whom psychological data were collected and that it accurately reflects the data actually collected between 1975 and 1978. The Board is also confident that these data reveal a harmful effect of lead among the 270 children with a variety of analytical approaches. The Board found that most aspects of this study that were being disputed by the complainants and Dr. Needleman's other critics were honest differences in how such studies should be conducted or in interpretation and judgements of data. Finally, perhaps the most remarkable feature of the printout is that it exists in the first place. If Dr. Needleman had the intent of fabrication and falsification (of results), much of the printout would have been buried long ago. Indirectly, the Board sees this as inconsistent with the intent to be scientifically fraudulent.

Adler obviously had this report in hand, but ignores these statements and many others. Nor does he mention that since my first article on lead and children's IQ was published in 1979, there have been over 20 published studies modelled on mine which show similar findings. All are in well-known referenced journals available at any medical library. It requires a special kind of hubris, given his selective way with documented facts, to presume to counsel journalists on what constitutes a proportionate response to the problem of lead in society.

Herbert L. Needleman, M.D., is a Professor of Psychiatry and Pediatrics at the University of Pittsburgh Medical Center.

YOU WERE RIGHT THAT MOST HOMES DO not have high lead levels in drinking water. As Consumer Reports noted, "the nation as a whole is not suffering from wide-spread high-level lead."

Yet I question your reliance on the

theory that low blood lead levels have a clear dose-response relationship with IQ and neuro-behavioral problems. With respect to low blood lead levels, all relationships are based on extrapolated theories. Very recently (February 1993), a group of international experts on lead toxicology from the World Health Organization found that studies "cannot provide definitive evidence of a causal relationship with lead... The essential problem is that observational epidemiology cannot provide definitive evidence of causality when the key statistical association is small, the temporal relationship is unclear and major confounders are present."

To suggest that virtually all children are "at risk" for lead poisoning is like saying virtually all children are at risk for getting struck by lightning. It is important to put lead poisoning in perspective.

Children's blood lead levels now average 4-6 µg/dL, about 1/2 the lowest level of concern. More importantly, they have declined significantly over the past 20-30 years and are expected to continue to drop. Most of today's parents had levels above 20 µg/dL (considerably above the new "concern level" of 10 µg/dL) when they were children.

— JEFFREY T. MILLER
Director, Environmental
Health & Government Affairs
Lead Industries Assoc., Inc.
New York City

Correction: "Getting the Lead Out" (Nov./Dec. '93) notes that lead concentrations in blood are measured in micrograms per deciliter, or µg/dL. During production, the font interface between our computer and electronic type failed, eliminating the "µ" character and rendering the abbreviated expression as "g/dL," or grams per deciliter. As one reader pointed out, "a kid with 80 g/dL blood-lead would be dead."

¹ Pocock, SJ; Ashby, D; Smith, MA (1987): Lead exposure and children's intellectual performance. *International J of Epidemiology*, 16, 57-67. ² U.S. Environmental Protection Agency The Solid Waste Dilemma: An Agenda For Action, Office of Solid Waste EPA/530-SW-89-019 (Washington, DC: February 1989 at P. 41 and 42.) ³ Cf: U.S. Environmental Protection Agency The Solid Waste Dilemma: An Agenda For Action, Office of Solid Waste EPA/530-SW-89-019 (Washington, DC: February 1989) at P. 41 and 42, and; U.S. Environmental Protection Agency Characterization of Municipal Solid Waste in the United States: 1992 Update, Office of Solid Waste and Emergency Response EPA/530-R-92-019 (Washington, DC: July 1992) at ES-3.

IS GARBAGE AN ENVIRONMENTAL PROBLEM?

November/December 1993

PATRICIA POORE'S RECENTLY STATED BELIEF that garbage is not an environmental problem is way off the mark.

She claims that "Americans made a lot less garbage than was predicted in the past few years . . . The throw-away society is a myth." Had Ms. Poore checked the data she would have found that just the opposite is true. Although the U.S. Environmental Protection Agency in 1988 set what it considered to be an "achievable goal" of reducing our per capita waste generation rate by 10%,² in fact, since then per capita municipal waste generation in the U.S. has actually increased by more than 10%, from 3.5 pounds per day per person to about 4.3 pounds.³ Contrary to the claims made by Ms. Poore, we are experiencing a much more rapid growth in waste generation than that predicted by the EPA.

She repeats, as fact, a claim by Judd Alexander (a retired official with a virgin paper company, part of an industry that contributes almost 40% of the municipal waste generated: no self-interest here!) that "garbage management as currently practiced does not contribute to pollution" and then asks us to believe a statement made by a representative of the Competitive Enterprise Institute that "the only threat posed by a landfill is a threat to land values or a scenic view." Really? A quick check with the U.S. EPA might have changed her mind. Fully 7% of global methane gas emissions now come from U.S. landfills alone, making these facilities one of the major global sources of this greenhouse gas (only a small fraction of U.S. landfills now practice gas recovery). Of the less than 20% of the landfills operating in

the U.S. that do comply with the Agency's new protective design requirements, most can continue to operate without liners despite a finding just five years ago by EPA that fully 75% of existing and closed landfills had documented leaching of hazardous substances into groundwater. As recently as five years ago the U.S. EPA found no meaningful differences in leachate quality between older and newer ("better designed") landfills.

Ms. Poore claims: "Standards [for U.S. waste-to-energy facilities] are extraordinarily high." May I inquire as to which standards she is referring to,



since the U.S. EPA has yet to issue emissions standards for these facilities? In fact, EPA is now negotiating a deadline for the issuance of such standards with the Natural Resources Defense Council, which successfully brought suit against the agency for failing to issue the Clean Air Act standards Ms. Poore seems to think exist.

Ms. Poore implies that pollution from incinerators ended after 1960. Despite Ms. Poore's reassurances, the U.S. EPA continues to classify U.S. waste-to-energy facilities as a "major" source of "hazardous air pollutants." Dioxin was not even identified as a hazardous emission from municipal incinerators until 1977. And it is certainly presumptuous of Ms. Poore to neglect entirely the issue of the dangers posed by incinerator ash.

There is much more to take issue

with in Ms. Poore's shallow and misguided analysis. Fortunately I have no interest or reason to do so: Neither GARBAGE magazine nor Judd Alexander nor the Competitive Enterprise Institute have much sway with any regulatory body that I know of. Thank goodness. Still, Ms. Poore should be ashamed of herself for having offered no data or perspective from any government agency.

— ALLEN HERSHKOWITZ

Senior Scientist
Natural Resources Defense Council
New York City

Patricia Poore responds: Our differences on all four points apparently come down to degree of faith in the pronouncements of the EPA, Dr. Hershkowitz.

I think democracy works, eventually, and so the EPA generally acts in the public interest. But a huge, federal-government bureaucracy is not the place I look for next-wave information or opinion.

Nevertheless, I don't argue with your EPA citations. It is common knowledge that only 20% of currently operating U.S. landfills operate in compliance with new requirements, and my sources agree that local groundwater contamination from old landfills qualifies as pollution. The premise of my essay was that the attention paid to garbage — media attention, regulatory attention — is out of proportion with garbage's actual "threat" to human health. I quoted those whose perspective is not regulatory to back up my own contention that the actual threat is less than has been implied, and certainly less than it was even a generation ago.

Please rest assured that I don't expect GARBAGE to "have sway with any regulatory body." I hope only to challenge

[Letters concludes on p.65.]

■ COMMENTARY

(Re)Born in the EPA

Even its Administrator acknowledges EPA is in disrepair. Reforming the agency means regulators must answer this question: Which hazards pose the most risk? By David Clarke

THREE YEARS AGO, ON A COLD, DRIZZLY December afternoon, hundreds of Environmental Protection Agency employees dashed from their labyrinthine headquarters at Waterside Mall in Washington, D.C., to Arena Stage across the street. They were hurrying to a commemoration of the agency's twentieth anniversary. Standing in the chill light rain, a handful of protestors raised placards bearing these mocking words: Environmental Pollution Agency. One or two EPA employees gave thumbs up as they hurried into the theater, "Yes that's right! That's us!" Others frowned or laughed.

Looking back on that day, I see the scene as symbolic of EPA's place in the public consciousness. Here were the guardians of our soil, water, and air, parading into a domed theater to hear the words of William Reilly, the first bona fide environmentalist to take up EPA's helm. He would praise the agency's successes, point to its future goals, and reiterate a central theme of his administration: We must engage in a great debate on prioritizing those hazards which pose the greatest risks to human health and the environment, and develop effective strategies for

dealing with them. Outside, like a cautionary chorus in a Greek tragedy, the placards of discontent dripped rain.

This past November a new think-tank, the National Environmental Policy Institute (NEPI), stepped forward to add its voice to the clamor, announcing plans to develop a "Reinventing EPA White Paper." What surprised me, as I sat through a daylong series of NEPI-sponsored panels listening to former agency notables talk about giving EPA a make over, was the harshness of the views expressed and the certitude that big changes must follow.

Consider the words of Robert Fri, the first EPA deputy administrator (1971 to '73), who leaned into a microphone and intoned, "What's wrong is deeply wrong, and will take a lot to fix." This from the man who helped invent the system everyone wants to reinvent. Even EPA's current Administrator, Carol Browner, says the agency must undergo "fundamental and substantive changes" to "leave behind the gridlock, expensive litigation, red tape, mixed signals, and inefficiencies of the past."

The bill of particulars against EPA is lengthy, its details varying depending on the list maker. But a

common theme underlies every inventory: The current system badly skews EPA's priorities. Superfund has swallowed \$6.7 billion to clean up a mere 84 of some 1,250 hazardous-waste sites whose risks, compared to other environmental problems, are relatively minor. By some estimates, up to 85% of Superfund's bloated bill has gone to lawyers' fees. Meanwhile, serious threats to natural ecosystems and human health persist, such as the destruction of wildlife habitats, overall loss of biological diversity, the exposure of large populations to air pollutants and pollutants in drinking water, and worker exposure to chemicals in both industry and agriculture.

Scientific inconsistencies are blamed for regulations which do little to protect health and the environment. A prime example: EPA's efforts to reduce risks from the radioactive gas radon. Inhalation is the main pathway to radon exposure, but EPA lacks the regulatory authority to control radon in the air. (The agency hasn't lacked in its ardor to publicize the risks — disputed by some scientists — posed by radon. See "Radon: The Silent Killer?" p. 22.) EPA does have the authority, under the Safe Drinking Water Act, to control radon in drinking water, and



ILLUSTRATIONS BY James Steinberg

the agency has proposed a "minimum safe threshold" for radon in water of 300 picocuries per liter (pCi/L). At that level, 0.03 pCi/L will volatilize into the air, contributing just one percent of the total airborne exposure to radon — hardly a threat.

If environmental regulations were freebies, misdirected priorities might not stir much of a protest. But since 1970, 9,000 pages of regulatory mandates have imposed some \$1.4 trillion in costs (1990 dollars) on American industries — not including the Clean Air Act Amendments of 1990, which require 120 new regulations

from EPA by 1995. According to EPA estimates, by the year 2000 the cost of complying with environmental regulations will consume \$160 billion a year, or 2.8 percent of the nation's Gross National Product.

Industry is not the only group that pays. In January '93, more than 100 mayors bewailed an "impending crisis" and bankruptcy because Washington has piled up environmental requirements, some of questionable benefit, while passing most of the tab for regulatory oversight to cities and counties. A Columbus, Ohio, official, Michael Pompili, complained his city

would have to spend \$16 million in initial capital costs and \$2.4 million annually thereafter to meet EPA's 3 parts-per-million standard for the herbicide atrazine in drinking water. "Yet there is no substantiation," said Mr. Pompili, "that [such a] low level of atrazine causes health problems."

With such extraordinary sums of money at stake, it's no wonder that the debate over weighing and prioritizing risk is so politically and emotionally charged. Complicating the issue is this fact: Risk assessments differ tremendously according to how critical pieces of scientific information are

Too Much Fiber Can Be Bad For You

An extensive study of sick building syndrome (SBS), recently conducted by Cornell University researchers, failed to find a link between gaseous indoor air pollution and SBS complaints. The real culprits, according to the study, are man-made mineral fibers falling from ceiling tiles and blowing in from the duct lining of air-conditioning vents. People either inhale the fibers or unwittingly transfer them to their eyes and noses via workplace dust on fingers.



and frequent office cleaning also help.

The study also suggests why workers who spend a lot of time in front of computer terminals may suffer more than co-workers who don't: The electrostatic fields generated by the monitors attract the fibers, causing them to drift in higher proportion towards the computer terminals, and thus toward the people sitting in front of them.

combined. The process of identifying a hazard and estimating the relation between dose and adverse health effects, under varying conditions of exposure, is "not a purely scientific activity," according to Sheila Jasanoff, chair of the Department of Science and Technology at Cornell University.

"Indeed, risk assessment is often described as an art rather than a science," Dr. Jasanoff wrote recently in the *EPA Journal*. "Risk assessment, like any artistic endeavor, requires the use of subjective judgement."

Some question whether risk

assessment should be used at all — that EPA should simply see to it that industry and agriculture use fewer toxic chemicals. Ellen Sibergeld, a professor of toxicology at the University of Maryland and the Environmental Defense Fund's senior scientist, told the journal *Environmental Health Perspectives* that health risk assessment "is a waste of time... We should be looking more closely at the distribution of death and disease, and then asking what portion can be prevented." It would then be up to Congress and EPA to formulate and

carry out the best policies to make prevention possible.

Nevertheless, many scientists and policy makers are concluding that in a world of growing hazards and limited resources, EPA must cut the Gordian knot of risk policy. Judge Stephen Breyer, the chief judge of the U.S. Court of Appeals for the First Circuit, articulates this point in his 1993 book, *Breaking the Vicious Circle: Toward Effective Risk Regulation* (Harvard University Press). Judge Breyer decries the "irrational" state of risk management in the U.S. and urges a solution: A centralized group of top officials whose mission would be to build a regulatory system which identifies our most serious environmental hazards and devises coordinated strategies for dealing with them.

It's too early to say whether the debate over setting environmental priorities will lead to real reform at EPA. But one thing seems certain: Policy decisions which involve hundreds of billions of dollars to deal with some environmental hazards which are relatively minor means EPA will remain mired in the old aspersions — Environmental Pollution Agency, Procrastination Agency....

The conflict over what constitutes a significant threat to human health and the environment is sure to be highly adversarial, and it's not going to fade away. To be reasonably certain that the hazards they target are significant, and the actions they take are effective, environmental regulators must inevitably prioritize environmental risks.

Mr. Clarke is the chief editor of *Inside EPA Water Policy Report*, a biweekly newsletter covering national water policies. He lives in Bethesda, Maryland.



"The Air Force has announced plans to retrofit each of its ICBMs, which carry from three to ten nuclear bombs that can wipe out entire cities, with new cooling systems. The reason for the switch is to eliminate systems that use CFCs, which can damage the Earth's ozone layer."

(RICHMOND TIMES-DISPATCH 1/4/94)

Triumph, Idaho, to EPA: Don't Tread On Me

Local residents were distraught when the EPA designated their town a potential Superfund toxic waste site. But after studying the data they've concluded the area is safe — and it's Superfund that needs cleaning up. By Stephen Stuebner

DONNA ROSE, A 40ISH ART DEALER and a member of Greenpeace and the Nature Conservancy, moved to the old mining town of Triumph, Idaho, in 1989. Beyond her front yard lies a 25-acre pond, rimmed by black tailings — the legacy of over a century of silver, lead, and zinc mining.

"When I want to relax, I go out for a walk on the tailings," she says. "I look for wildlife tracks and gaze at the glitter in the sand. It's beautiful."

Not to the Environmental Protection Agency. Triumph's lead- and arsenic-laced tailings, say EPA regulators, constitute one of the most dangerous toxic-waste sites in the nation. The tailings are waste by-products from underground ore lifted out of three mines. In assessing the piles' toxicity for listing as a Superfund cleanup site, EPA gave Triumph a score of 90.3 out of a possible 100 — the highest score of all the Superfund sites listed in the United States.

The EPA's score is based on the maximum environmental and human health risks associated with about one million cubic yards of tailings which surround many of the 17 homes in town. EPA officials claim the community's drinking water is contaminated with lead, and residential soils and blowing dust pose an acute health threat. Excessive levels of lead in the blood stream can cause neurological disorders and learning disabilities.

Arsenic is a cancer-causing heavy metal if ingested in sufficient quantities.

Donna Rose and the rest of Triumph's residents, all 51 of them, were shocked when EPA authorities first visited their town in the fall of 1991. The regulators told them their water was unsafe to drink, and their children could be eating toxic mud pies when playing in the dirt.

"For two months, I was sick over it," recalls Heidi Heath, a mother of two children, aged four and seven. "I thought, what have I done to my children?"

But her fears were eased

after independent analysts pored over EPA's data. Blood-lead and urine-arsenic tests of community residents, conducted by state health authorities, showed below average readings indicating that the tailings do not pose an imminent health threat. Twenty years of self-testing on Triumph's community well by town officials failed to reveal a single high lead reading, residents say.

"I feel 100 percent fine," Ms. Heath says. "I would never leave the area." And Donna Rose, who would like to subdivide her property, has made it a personal crusade to prove the EPA goofed in Triumph.

"I've contributed more than



Escaping the "Bottom-Ten"

The Council on Economic Priorities, an environmental public-interest research organization, removed four companies from its 1993 "bottom-ten" list of the worst corporate environmental performers and offered them commendations instead.

Cargill, the largest privately-held company in the U.S., was slammed last year for having the worst air-permit compliance record in its field and for dumping 40,000 gallons of phosphoric acid into Florida's Alafia River, among other complaints. They got off the '93 list for implementing a wide array of measures to prevent phosphoric acid spills and for setting a new standard for public disclosure by a private company.

General Motors was cited last year for releasing three times as many federally defined "toxics" as any other domestic auto company, and for planning to build an incinerator on Indian tribal land, where it could avoid state environmental regulations. GM escaped the new list after it joined up with the other car makers and the Clinton Administration to work on developing a super fuel-efficient car. The company also endorsed a 10-cent gas tax to be phased in over five years.

Georgia-Pacific made last year's list for importing large amounts of rainforest timber, for racking up more than twice as many air-permit violations as any other forest-products company, and for over-cutting. G-P has now won commendations for picking former EPA Administrator Lee Thomas to turn around the company's environmental policies. Mr. Thomas has committed G-P to issuing an annual environmental report with specific goals, timetables, and publicly disclosed annual monitoring of its environmental progress.

USX, which owns U.S. Steel and Marathon Oil, was named on last year's list for illegally dumping contaminated wastewater and for repeated air-pollution violations. USX earned its way off the list by winning a federal Dept. of Labor award for worker safety, by reducing pollution emissions, and by issuing a rare disclosure of substantive environmental information about its toxic releases.

Four of the companies from last year's list remain: GE, DuPont, MAXXAM (an aluminum and forest-products company), and Rockwell. The others joining them are Exxon, Commonwealth Edison, International Paper, Louisiana-Pacific, Texaco, and Texas Utilities.



\$10,000 to environmental groups this year, and here I am fighting the EPA," she fumes. "Our case reveals everything that's wrong with the EPA and the Superfund program."

EPA officials disagree. They fear children will eat contaminated dirt, and they've proposed excavating at least four residential yards with high levels of lead and arsenic in the soil.

"Even if there wasn't a single human being living there for 50 miles, the site would still qualify [for Superfund listing]," says David Bennett, EPA National Priority List coordinator in Seattle. "We don't guarantee that someone will drop dead from cancer, we look at probabilities."

Probabilities. That's what the dispute in Triumph boils down to — theoretical risk. Despite tests on animals indicating Triumph's tailings do not pose an acute health threat, as well as the blood and urine tests of Triumph residents, environmental regulators decided computer models are the best indicators of potential health threats from the tailings.

But the people of Triumph, not to mention ASARCO, INC. (a multinational mining corporation), the Idaho Land Board, and Triumph Minerals Inc. — the groups considered "potentially responsible" for the contamination — don't want to be saddled with the Superfund stigma and the monstrous expense of cleanup based on some theoretical risk.

Triumph residents act like they're ready to run EPA out of town. They have hired Denver attorney Robert W. Lawrence, a veteran of Superfund cases, to challenge the agency's data. With the aid of Dr. Greg Norrell, a hydrogeologist at the U.S. Department of Energy's Idaho National Engineering Laboratory, Mr. Lawrence recalculated Triumph's hazardous ranking score to a total of 28.3, two-tenths shy of the minimum score required for Superfund listing.

Mr. Lawrence contends background levels of lead and arsenic in Triumph, which is situated in a highly mineralized zone, magnify overall concentrations in the tailings piles; and he argues that by failing to test filtered samples of the community's drinking water, EPA's calculation of lead levels in the water are unduly high.

How did Mr. Lawrence arrive at a score which is barely, but conveniently, shy of the legal threshold for Superfund listing? "We didn't try to manipulate the numbers," he says. "We simply used more realistic assumptions, and when you plug in the different values, it leads to a lower score."

It's not uncommon for communities to recalculate their score so it lands just below the threshold, counters EPA's David Bennett. "I'd stand behind our scientists any day compared to [Lawrence and Norrell]."

TO DONNA ROSE AND OTHERS, THE TRIUMPH case is more than a story of dueling data — it shows that the entire Superfund program is in need of reform.

Launched in 1980 as CERCLA — the Comprehensive Environmental Response, Compensation, and Liability Act — Superfund is actually a trust fund to be used to clean up toxic-waste sites, after which the polluters would be billed their share of the costs by the EPA. It's had a shaky record at best. Investigations by Congress' General Accounting Office show Superfund wastes millions on environmental studies and legal fees while few dollars are applied to actual remediation.

"We study, we study, we study and we never clean up," complains P. Odem, president of Local Government for Superfund Reform, a national group representing communities pushing for changes in Superfund. "The system is not just screwed up, it's wrong."

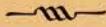
Mr. Odem [continued on p. 18]

"Ozone — Scam or Crisis?" (Sept/Oct '93) One of the unanswered questions surrounding the depletion of atmospheric ozone is whether it does indeed result in increased human exposure to harmful ultraviolet radiation. A recent study published in *Science* by researchers from Canada's Atmospheric Environment Service begins to fill the gap.

The study shows that declines in stratospheric ozone do result in increased UV-B. Researchers J.B. Kerr and C.T. McElroy found that between 1989 and 1993, atmospheric ozone levels around Toronto declined 4.1% a year in winter and 1.8% a year in summer. With instruments taking measurements once or twice an hour daily, they found that UV-B radiation increased more than 5% a year for the same time period. The researchers took great care to establish the accuracy of their instruments; they also discounted clearer skies or reduced low-level air pollution as possible explanations for the higher UV-B readings.

But many questions remain: Was the sharp ozone drop caused by man-made chemicals, or by an unusual combination of natural factors, such as the 1991 eruption of Mount Pinatubo? (When volcanoes erupt they inject hydrochloric acid into the atmosphere, which may result in ozone depletion.) Is the four-year decline part of a long-term trend, or an historical anomaly? There is no way to know without longer-term studies.

In any event, Toronto-ites need not fear major, near-term increases in skin cancer from increased UV-B. As the study's authors point out, the observed levels show "large fractional increases in small values. For this reason, it may not represent a significant increase in terms of its biological impact."



"Here Comes The Sun" (April/May '93) Photovoltaics may be moving from off-the-grid homes — the subject of our story — to the energy grid itself. The state of California recently awarded the Sunnyvale-based Solar Energy Applications Corporation a \$1 million grant to begin producing photovoltaic cells (which collect sunlight and convert it into electricity) that will be used by electric utilities to quickly supplement peak power when needed. The pollution-free solar juice will cost between 6 and 20 cents per kilowatt hour. (Power from the nearby Diablo Canyon nuclear power plant costs about 10 cents per kilowatt-hour.)

The key to this next step in the evolution of solar power is a technological breakthrough by SEA Corp. researchers, which allows a solar panel smaller than conventional solar collectors to deliver as much electricity at one-third the production cost. The panels use refined "concentrators" to magnify the sun's energy more than tenfold, reducing the number of expensive solar cells needed to produce a given amount of electricity.

The Sacramento Municipal Utilities District, which supplies energy to 416,030 households, has signed up as SEA Corp.'s first big-league customer.



update



PRESS CLIPS

FROM OUR COLLEAGUES IN THE MEDIA

Asbestos Discovered, Reporters Go Berserk

UNQUESTIONABLY, IT WAS BIG NEWS: Flawed asbestos inspections kept a million New York City students out for 11 days at the start of the school

year while the city spent \$30 million to re-inspect hundreds of public-school buildings. Unfortunately, much of the news cover-

age was a vivid example of sacrificing scientific complexities when they get in the way of fingering the bad guys. Front-page treatment of asbestos panic was typified by *Newsday*, which hyped the story in its headlines (e.g., "Crisis in Classroom" by Otto Strong and Barbara Frojmovich, Aug. 9) and continually appended the prefix "cancer-causing" to "asbestos" in its copy.

Newsday assigned a team of reporters to find out who was responsible, but it wasn't much interested in explaining the health risks posed by undisturbed asbestos fibers. An unbylined Q&A ("Is the Fear Greater Than the Risk?"), buried on page six of the Aug. 10 edition, reports: "The precise risk of disease from low-level, short-term exposure to asbestos is unknown." At least 17 leading asbestos researchers expected the paper to go further. Irked by media fear-mongering, they wrote a letter to the *New York Times* ("Call Off the Asbestos Scare"), arguing that the level of airborne asbestos fibers in schools is so minute that the risk to children is a "non-problem."



Most of the city's schools had reopened when the scientists' letter was published on Sept. 23.

Good News Doesn't Sell

AIR QUALITY IMPROVED DRAMATICALLY for millions of Americans last year, but that wasn't considered newsworthy by most of the nation's major media outlets.

The EPA's annual air quality report, released Nov. 2, shows the number of Americans living in areas which fail to comply with the federal ozone standard went down by some 37% in 1992. That's down to about 54 million Americans from the 86 million in previous years, "the lowest level in 20 years," according to the Gannett News Service. Most news editors



DOWN IN THE DUMPS — I don't think I'll be taking tips on environmental stocks from *Forbes* anytime soon. Its Aug. 2 cover story, a thumbsucker on WMX Technologies, Inc. ("Dean Buntrock's Green Machine"), gushes that the trash king's "technology is the best, its experience priceless, its future, barring bad mistakes, all but assured in a world where the environment has become a near universal concern." ■ Two months after the story ran, WMX was making investors sick. On Oct. 19, the waste maven's stock was taken to the cleaners following its announcement of a \$127.2 million third-quarter loss, including a \$363 million after-tax write-down of its haz-waste business. ■ If reporter Subrata N. Chakravarty had followed the garbage, *Forbes* might have forecast the stock-bashing. Fact is, haz-waste disposal is so costly that American industry is cutting its output and managing more of it on-site. Sure, a tough new federal landfill law for municipal trash is favoring heavily capitalized disposal outfits like WMX. But the phantom garbage crisis has created a huge glut in landfill space, driving dump prices down at least for the short run. And numerous state laws mandating recycling — currently a money loser for many materials — will eat into WMX's margins.

judged the story a snooze. A computer database search shows only Gannett, USA Today, and the San Jose Mercury News covered the story.

Reporter Scott Thurm, who wrote the *Mercury News* piece, told the newsletter Environment Writer: "Had there been a 37% increase in the number of people living in [areas out of compliance with ozone rules], environmentalists would have been calling press conferences. We would have seen broadcasts on the network news, tailpipes smoking and smokestack plumes."

Up In Smoke

WHILE ENVIRONMENTALISTS CONTINUE a crusade against air pollution from municipal refuse incinerators, a prescient *Wall Street Journal* piece by Jeff

Bailey ("Fading Garbage Crisis Leaves Incinerators Competing for Trash," Aug. 11) shows that it's the unsustainable economics of burning garbage that's really crippling the industry. The recession, and increased recycling, mean many municipalities aren't generating enough

burning garbage that's really crippling the industry. The recession, and increased recycling, mean many municipalities aren't generating enough



BIZMAN GETS PRP'D — Out of all the ink that's been spilled over the Superfund mess, the most compelling piece by far is Geoffrey Norman's profile of a PRP, published in November's *American Spectator* ("Superfund as Godzilla"). A PRP is the "Potentially Responsible Party" who covers the tab for a Superfund investigation, and may ultimately be liable for cleanup of a contaminated site. The PRP in question is Vermont's Biff Mithoffer, a "socialist businessman" who took over an old dump in Sunderland and transformed it into a recycling center. ■ The Sunderland dump, it turns out, was classified by the EPA as a Superfund site in 1991. "Anyone who has put anything into a site," writes Norman, "no matter how small, can be held accountable." Mithoffer never dumped at the dump, but he had bought several trucks from a small hauler who had used it. For the EPA, that makes him liable. And so begins Mithoffer's "Kafkaesque" journey into the world of Superfund. Three years later he still lives in a kind of netherworld: His share of the ongoing investigation totals \$30,000 (and climbing), the nearby town of Bennington's share amounts to three-quarters of a million dollars (and climbing), and the EPA has yet to remove a "single shovelful of dirt" from the site.

trash to keep the plants burning at full blast.

The kicker might well be "flow control," whereby a municipality reserves the right to direct all of its trash to a favored disposal site. The practice is vital to incinerators, reports Bailey, which generally charge prices far higher than dumps. The Supreme Court has agreed to consider a challenge to flow control, and a decision against it "could spark an all-out price war in the disposal business," Bailey predicts. "Dumps, with relatively low fixed costs, could ride out a price war. Many cash-hungry incinerators couldn't."

Toxic Copy

NEWS EDITORS VALUE BREVITY. A 540-word item in USA Today ("EPA Proposes \$20 Million in Fines for Waste Burners," Sept. 29) illustrates why the axiom "make it tight" isn't always desirable in environmental reporting.

The story: The EPA cites 30 companies for violating hazardous waste incineration laws, including Rhone-Poulenc, located near Insti-

tute, West Virginia. The report notes the Rhone-Poulenc plant, formerly owned by Union Carbide, once produced methyl isocyanate, the chemical responsible for the Bhopal disaster. "A Harvard University study," writes reporter Rae Tyson, "found that area children suffer from 12% to 24% more respiratory ailments than others."

That's about it. Left unreported: whether the Harvard study established a link between increased respiratory illnesses and nearby chemical plants ... or indoor-air pollution, or second-hand cigarette smoke. Perhaps there isn't any environmental connection — the findings may well be due to genetics or coincidence or flawed data.

Without additional information, we just don't know. But the way the story stands, it doesn't take a great leap to infer that dirty Rhone-Poulenc is responsible for sick kids in Institute — or that the reporter meant to imply just that.



For the Record

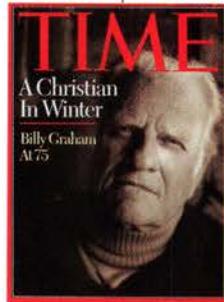
★★★ Most of the mainstream environmental press has figured out that we never had a trash crisis after all. The American public hasn't gotten the message. According to a recent survey by Gerstman & Meyers, a "brand identity" consulting firm, Americans believe garbage is the most important environmental issue facing the nation. Air quality came in second.

★★★ Despite glowing profiles, Bruce Babbitt may be no more successful at heading the Interior Department than the notorious James Watt. Preposterous? James Conaway, new Washington editor for Harper's, predicts in the Dec. issue ("Babbitt in the Woods") that Babbitt will be undone both by Republican appointees, who have burrowed deep into Interior, and his boss. "Clinton defers to people, not trees. Unlike Reagan, he doesn't view the latter as dangerous, just mutable to our requirements."

★★★ The old adage that "the dose makes the poison" apparently holds little sway with *Time*. Its story on unsafe drinking water ("Toxins [sic] on Tap" by Michael D. Lemonick, Nov. 15), drawn largely from a study by the Natural Resources Defense Council, reports 50 million Americans drink water "tainted" by radon, "a proven cause of both lung and rectal cancer." How much radon in water is thought to be unsafe? *Time* doesn't say.

★★★ A news item from January's *Scientific American* hits where it hurts: A recent study found that boys in Taiwan exposed to PCBs while in utero developed smaller penises as they matured compared to unexposed boys ("Dioxin Indictment" by Marguerite Holloway). And I'd just gotten over worrying about mercury in my fillings.

— BILL BRENN



Industry to Government: Regulate Us

■ A new trade association of hazardous-waste incineration companies recently formed in Washington D.C. with the sole aim of lobbying for strict, by-the-letter enforcement of environmental regulations. Sound strange? Environmental rules represent a potential windfall to the environmental-services firms they are intended to regulate. While marginally capitalized companies scramble to meet tough new regulations, higher market share goes to the larger clean-up companies which are better positioned to comply.

Consider ARTT (Association for Responsible Thermal Treatment), a group representing six of the nation's largest haz-waste incinerator companies. In 1984 Congress amended the nation's primary solid- and hazardous-waste law, the Resource Conservation and Recovery Act (RCRA), to require that all organic hazardous waste be incinerated to break down organic hydrocarbon compounds into harmless components. In response to the RCRA amendments, the haz-waste treatment industry invested hundreds of millions of dollars in new equipment and procedures. The result was a cost increase for industries looking to dispose of haz-waste.

Many haz-waste producers turned to cement kilns, which the EPA has regulated more leniently than disposal incinerators, resulting in lower fees. It is the RCRA loopholes benefitting cement kilns which ARTT aims to combat.

If haz-waste burning in cement kilns has the same federal oversight as incinerators, ARTT says, less pollution would occur and the cost of disposal would go up, resulting in less haz-waste produced. Presumably, ARTT member companies would also be able to reclaim a higher share of the haz-waste disposal market and boost their bottom line.

contends EPA's priorities should focus on remediating those hazardous sites which pose the greatest risk to local populations. The agency's approach, he says, gives undue attention to "potential" health risks instead of documented problems. He cites a 1991 GAO study, which found that EPA and the Agency for Toxic Substances and

Disease Registry made overly general conclusions about the relative health dangers associated with 951 Superfund sites.

Which sites pose a real threat to human health? The Agency for Toxic Substances won't say without a mouthful of qualifiers. Of all the sites surveyed, regulators concluded 84% pose a "potential or pos-

sible" health risk, while 12% pose an "ongoing or probable risk" and 4% present "little to no risk." Such general conclusions do not help regulators pinpoint the most dangerous sites, the GAO report observed.

Congressional oversight hearings on reauthorizing Superfund are already underway. Don't be surprised if Donna Rose appears on the witness stand. "Before it's all over, Superfund reform will be as [rancorous] as the health-care issue," she predicts.

Meanwhile, Triumph residents are working with the Idaho Land Board to sidestep the Superfund process and commence a state-led, fast-track cleanup of their own. If the state succeeds in taking over cleanup operations of the site, authorities estimate that cleanup costs could be reduced from more than \$100 million to less than \$10 million.

Congressman Mike Crapo, R-Idaho, and a member of the House Transportation and Hazardous Waste Subcommittee, is petitioning EPA staffers in Washington, D.C., to make that happen. EPA officials say they are listening. "We're open to doing something creative here. It's pretty clear that the past approach hasn't worked too well," concedes Mark Masarik, EPA hazardous waste coordinator in Boise, Idaho.

Donna Rose believes a state-controlled cleanup project would mean her fellow residents could regain control of their destiny. "We're a political embarrassment to the EPA," she says. "The best way for them to save face would be to drop us from Superfund consideration and leave us alone."

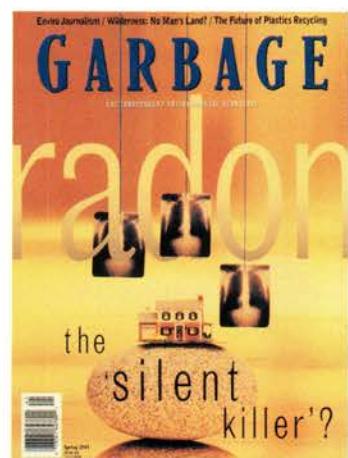


A freelancer living in Boise, Idaho, Mr. Stuebner first wrote about Triumph for High Country News, a biweekly newspaper covering environmental issues in the Rocky Mountain West.

At Issue

READERS HAVE ASKED FOR MORE BACKGROUND ON AUTHORS, including their specialties and affiliations. Here it is, in this new introduction to features. Summaries provide insight for those not inclined to read every word in every one of our admittedly long articles. The "at issue" closings succinctly address the controversy or question posed (or implied). ■ As this issue came together, we noted that it could be subtitled "Where Science Meets Policy, or the EPA Gets the Hot Seat." Read the cover story on radon-abatement policy in context with two lead items in "Lifting the Lid" (pp. 10, 13), which look at EPA decisions from differing perspectives. Policy makers have a difficult task. But there is cause for optimism: the country has not reached regulatory gridlock yet; and with open debate, we can do a better job.

— The Editors



Radon: The 'Silent Killer'?

by Leonard A. Cole

(page 22)



LEONARD COLE'S BOOK *Element of Risk: The Politics of Radon* was published in 1993 by the AAAS Press, a publishing division of the prestigious American Association for the Advancement of Science in Washington. The book won high praise from *Health Physics*: The Radiation Protection Journal as well as *Library Journal* and *Publishers Weekly*.

Dr. Cole's writings have appeared in numerous professional journals as well as the *New York Times* and its Magazine, *The Nation*, *The Sciences*, and *Common Cause*. His books include *Politics and the Restraint of Science* (Row-

man and Allanheld, 1983) and *Clouds of Secrecy: The Army's Germ Warfare Tests Over Populated Areas* [1988, 1990], which drew wide acclaim.

Leonard A. Cole is an adjunct professor of political science, and a faculty associate in the Program in Science, Technology, and Society, at Rutgers University in Newark, N.J. A recognized authority in the area of science and public policy, he holds a Ph.D. in political science from Columbia University.

■ **ARTICLE SUMMARY** The EPA is running an aggressive, even alarmist, campaign to persuade American homeowners to test for radon gas. Testing and remediation may cost \$45 billion. Yet the EPA has deliberately minimized the uncertainties of short-term testing, of calculating health risk, and of remediation success, in order to provide simple "pre-

scriptive guidance."

Assumptions of risk are extrapolated from studies of miners exposed to thousands of pCi/l of radon for prolonged periods. Models assume a linear, nonthreshold dose-effect relationship (that is, the risk of low doses is assumed to be directly proportional to the risk demonstrated at high doses). The author explains the EPA's questionable method for arriving at the targeted "safe level" of below 4 pCi/l.

After searching for epidemiological evidence of a clear correlation between lung cancer and residential radon, the author concludes that, at best, a very few investigations have yielded ambiguous results. Yet, he points out, proposed legislation would step up the campaign further, poten-

tially citing one-third of the country's housing stock as "high risk," mandating school testing, and requiring testing of homes before any real-estate sale involving federal financial backing.

In conclusion, the author charges that the nation's aggressive radon policy has been driven by the unique opportunity presented by the gas. No industrial "culprit" exists who might underscore the uncertainties. And because homeowners pay for their own testing and remediation, no industry or public dollars are involved. Dr. Cole argues that the national radon policy is "environmentalism on the cheap."

■ AT ISSUE The journal *Nature* says: "Leonard Cole is so deft in analysing the science and politics of radon that it is hard to know whether to laugh or cry. On the one hand, EPA's public pronouncements vastly overestimate the danger from ionizing radiation in basements by extrapolating directly from huge exposures in mines.... On the other hand, when EPA goes to Congress it is met with insistent demands not only to reduce permitted levels to what is technically feasible but also, in the language of the 1988 Indoor Radon Abatement Act, that the nation's long-term goal should be to have all its buildings 'as free of radon as the ambient air outside of buildings' at a cost of more than \$1,000 billion (were it possible to achieve)."

At issue is the controversy over how to manage risk when opposing extremes of positions apparently lay claim to the same science. What degree of certainty (of health risk) should precede what kind of expenditure? These issues are addressed, too, in Stephen Page's counterpoint for the EPA.

In his book, Dr. Cole himself urges readers to see radon as a surrogate for many environmental issues where scientists, legislators, activists, and regulators are at odds. His article continues to explore the issue of providing open and accurate information, including uncertainties, to the public.

No Man's Land

by Elizabeth Pennisi

(page 32)



ELIZABETH PENNISI HAS been a science writer and editor for ten years at magazines, universities, and United Press International. She is currently a staff reporter covering life sciences for *Science News*. Ms. Pennisi's special interest is issues in conservation; her work has also appeared in *National Wildlife*, *Nature*, *Discover*, *Arizona Highways*, and *The Scientist*. Before becoming a journalist, she worked for an engineering company doing evaluation surveys of sewer systems.

■ ARTICLE SUMMARY Led by Earth First! founder Dave Foreman, a growing band of environmentalists and field biologists have launched an audacious plan calling for the creation of a vast system of connected wilderness reserves that would crisscross the entire continent. The "Wildlands Proposal" would return large carnivores such as grizzly bears and wolves to their former ranges.

The Wildlands plan dovetails with current ecological and economic realities. Many ecologists realize that, to maintain biological diversity, they should be taking a broader view that encompasses large-scale preservation of habitats and ecosystems. Current efforts to rescue endangered species aren't working. Furthermore, economists who believe environmental quality is a primary economic resource view the Wildlands proposal as compatible with economic growth and well-being.

The creators of this seemingly macho plan emphasize that it is long-term, to be carried out over decades or even centuries. For now, the plan provides a basic framework for local groups to carry out conservation strategies that would truly protect entire ecosystems.

■ AT ISSUE The science issue is, of course, whether a plan of this scope is in fact the only way to maintain healthy ecosystems and assure species diversity.

Most ecologists concede that existing wildlife refuges may be too small and too fragmented; and expensive, emergency-room action to save endangered species are probably inadequate. But is the Wildlands proposal too wild a solution? Surely, if the plan doesn't grapple with economic constraints and personal values regarding ownership of the land, it will be shot down.

At issue, too, in reading the proposal, is no less than a paradigm shift for Western civilization.

Dueling Quotes

by Bill Breen

(page 40)

BILL BREEN, MANAGING EDITOR OF *GARBAGE*, was formerly a feature writer for the *Christian Science Monitor* and an adjunct professor of journalism at the City University of New York. His articles on the environment have appeared in *Yankee* and *Modern Maturity* magazines, and in the *Los Angeles Times*, the *Chicago Tribune*, and the *San Francisco Chronicle*.

■ ARTICLE SUMMARY In a recent survey, more than one out of three environmental journalists confessed that many of their peers have an anti-business bias. A few journalists publicly conclude that the press has provided a "largely uncritical forum" for environmentalists. But, in their recent rush to right that perceived wrong, have reporters gone too far in the other direction? Environmentalists certainly think so, as they decry a recent spate of articles they claim are blatantly anti-environment.

Several veteran reporters who detect advocacy journalism in the environmental field are calling on colleagues to back off. They argue that journalists must return to objective, balanced reporting, where all sides get equal time.

■ AT ISSUE Does traditional "equal time" objective reporting measure up to the difficult task of communicating complex, technical questions regarding, say, global temperature increase and strato-

spheric ozone depletion? Those who think not say scientists don't have all the answers. Does scientific uncertainty mean that journalists *must* make judgement calls? At issue is what role reporters should take in participating in environmental debate.

Time to Dump Plastics Recycling?

by Art Kleiner & Janis Dutton

(page 44)



CONTRIBUTING EDITOR
Art Kleiner is co-author of *The Fifth Discipline Fieldbook*, to be published by Doubleday/Currency this summer. He is currently writing *The Age of Heretics*, a history of the social movement of people trying to change large corporations for the better.

He is a consulting editor at the Center for Organizational Learning at the Massachusetts Institute of Technology. For GARBAGE, he has written about the quest by some economists for a GNP that includes ecological values (Feb/March '93); and he's taken an inside look at Dow Chemical's struggle to balance economics and technology with environmental values (July/August '91).

Janis Dutton is a writer and an elected official. She was managing editor of *The Fifth Discipline Fieldbook*; and she serves as a member of the City Council of Oxford, Ohio, a community grappling with solid-waste issues.

■ ARTICLE SUMMARY The collapse of a widely heralded joint venture between Waste Management Inc. and DuPont to recycle millions of pounds of plastics per year is leading some recycling professionals to conclude that the national plastics recycling system, as it exists today, is not workable economically.

Plastics recycling was greatly oversold in the late '80s. The result is a recycling system that seems to ignore the first lesson in basic economics: maintaining the precarious balance between supply

and demand. To jump-start markets, some states are contemplating "rates and dates" legislation, which would make manufacturers responsible for using a certain percentage of recycled plastics in their products or packaging. The plastics manufacturing industry is fighting every one of the measures.

The outlook for plastics recycling is decidedly gloomy, but there is a silver lining: PET, the plastic used in soft-drink bottles, is something of a recycling success story. Recyclers might look at PET as a model.

■ AT ISSUE Large companies pay lip service to recycling as a "principle," but are in fact doing very little in the way of recycling post-consumer plastics. Some say source reduction and incineration are better ways to manage discarded plastics. At issue is whether the diverse plastics recycling industry can work together to create an extensive recycling infrastructure. Without cooperation from manufacturers, prospects for plastics recycling don't look good.

Keeping Warm & Staying Cool Economically & Efficiently

by Daniel Yoon, Richard Heede, Amory Lovins, and Hunter Lovins

(page 52)

THE AUTHORS ARE TOP BRASS AT THE ROCKY Mountain Institute in Snowmass, Colorado. (Daniel Yoon is senior research associate; Richard Heede is director of the energy program; Amory Lovins is director of research; Hunter Lovins is executive director.)

RMI, founded by energy analysts Amory and Hunter Lovins in 1982, is a nonprofit foundation for research and education. Its mission is to "foster the efficient and sustainable use of resources as a path to global security." The Institute focuses in seven areas: Energy, Transportation, Green Development, Water, Agriculture, Economic Renewal and Global Security.

■ ARTICLE SUMMARY The dollar costs and environmental impacts of home heat-

ing and cooling are summarized to introduce the real importance of conservation. Energy bills have been cut \$275 billion a year through increased efficiency since 1973. Nevertheless, RMI estimates that far, far greater efficiency is possible through advances in lighting, space cooling and heating, motor systems, and appliances. Some of these innovations have been used in the RMI building and other prototypes.

In the meantime, the Institute recommends simple, cost-effective measures to save money and use less energy at home. The strategy, explained here, includes weatherization, insulation, and window improvements or retrofits. The report concludes with useful referrals.

■ AT ISSUE RMI claims that using energy inefficiently not only has an unnecessary environmental impact, but also dulls our economic competitiveness as the country wastes \$300 billion a year through inefficient technologies and outdated practices. Yet energy efficiency is not financed on the same terms as energy supply: Consumers investing in "efficiency" expect to cover their costs in about two years. Nevertheless, energy-efficiency measures that are economical in the relatively short-term can and do make a difference in energy consumption.

COMING IN THE SUMMER 1994 ISSUE

The Chlorine Controversy

IVAN AMATO, A FORMER STAFFER AT Science magazine and now an independent science writer, tracks the environmentalist crusade to ban chlorine — the single most important ingredient in modern industrial chemistry.

Is a phaseout scientifically indefensible? patently ridiculous? Listen up: A growing, international consortium of environmentalists, government commissions, and professional societies conclude that chlorinated organic chemicals are the root of many public health evils.

The EPA says radon is a "household intruder" that contributes to thousands of lung-cancer deaths each year. What's left unsaid: The agency is deliberately minimizing the uncertainties in calculating radon risk. By Leonard A. Cole

RADON

THE SILENT KILLER?

Photograph by Ron Baxter Smith



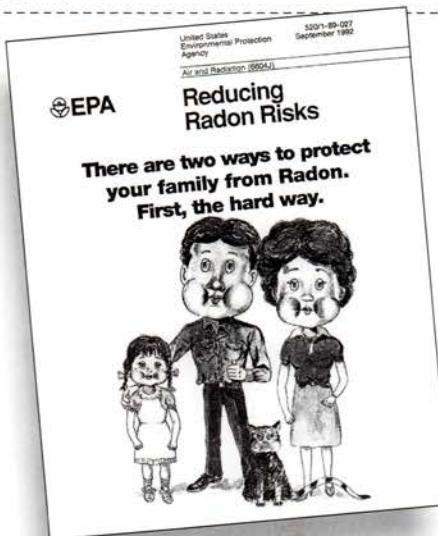
THE BROCHURE COVER DEPICTS A YOUNG FAMILY, INCLUDING THEIR PET KITTEN, ALL WITH LIPS SEALED, CHEEKS ballooned out, eyes fixed in desperation. "There are two ways to protect your family from Radon," the caption reads. "First, the hard way. Holding your breath." ■ Thus begins a publication by the U.S. Environmental Protection Agency alerting the public that millions of Americans are being exposed to radon — allegedly a leading cause of lung cancer. Since the late 1980s the agency has urged that every home and apartment below the third floor be tested for radon gas, and that actions should be taken to reduce radon levels if concentrations exceed 4 picocuries per liter of air (4 pCi/L). Is EPA's aggressive, sometimes alarmist campaign warranted? ■ The agency estimates that 6 to 8 million homes (nearly 10 percent of the nation's total) have concentrations in excess of 4 pCi/L and should be remediated. It also estimates the cost of testing

and fixing will be \$45 billion.¹ What the EPA does not say, however, is that many of the scientific and technical assumptions behind its radon policy are steeped in uncertainty. Indeed, in its zeal to have people test and fix their homes, the agency has deliberately minimized the uncertainties in calculating radon risk.

EPA's Assumptions

THERE IS NO QUESTION THAT RADON POSES health hazards. As far back as the 16th century, long before it was identified as the culprit, radon's harmful effects were noted among East European uranium miners. As many as half the men working in the mines contracted lung disease, now understood to be cancer. With the dawn of the nuclear age, uranium mining increased, accompanied by an increase in the number of miners in Europe and the western United States who succumbed to lung cancer. In the 1950s and '60s, epidemiological studies on miners confirmed that prolonged exposure to high concentrations of radon gas in mines does cause lung cancer.

The EPA's assumptions about the risk of radon to home dwellers are based on extrapolations from the miners studies. The miners were exposed to hundreds and thousands of pCi/L for prolonged periods. Using models that project a linear relationship between radon exposure and lung cancer, the agency says that between 7,000 and 30,000 annual lung cancer deaths are attributable to radon. The EPA has established 14,000 radon deaths as a working number which, in its brochures, is



depicted as greater than the combined annual deaths from drownings, fires, and airline crashes. The explicit message follows: Test your home for radon and reduce the levels to below 4 pCi/L.

Unlike deaths by accidents which are determined by actual count, however, fatalities from residential radon are theoretical. The agency's models assume that even tiny amounts of radon pose some risk, and that only a level of zero can be considered safe.

Some scientists believe that a threshold exists below which radiation poses no danger. Others think it better to use no-threshold models to be as safe as possible. But all agree that the matter is uncertain. Reports by the National Academy of Sciences and the National Council on Radiation Protection and Measurements,² two of the nation's most respected scientific institutions, confirm that radon risk models are based on many unproved assumptions.

Uncertainties in the models arise from lack of information in past studies

about working conditions of miners, breathing rates, and effects based on age and gender. Moreover, about 85 percent of the 130,000 annual lung cancer deaths in the U.S. are caused by smoking. A preeminent weakness in the miner studies is that most did not control for smoking habits, though a great majority of the uranium miners reportedly were smokers.

In considering the presumption that low-level radon exposure is dangerous, it is worth remembering that the gas has been ever-present since the planet's origin. As with other natural phenomena including water, sunlight, and gravity, under certain conditions radon can be dangerous. But the human species has evolved in a natural radon environment that has changed little over millions of years.

Because the gas does not dissipate as readily in an enclosed structure as it does outdoors, indoor radon concentrations may be somewhat higher. But humans have long dwelt in confined areas, whether in caves, huts, or houses. (Contrary to earlier suppositions, studies show the degree of insulation has little effect on radon concentrations.) There is no evidence that either indoor or outdoor averages are higher now than they were thousands of years ago. One may therefore wonder what prompted the government's urgent policy.

"The Watras incident really changed the ball game," recalls Richard Guimond, who became the first director of EPA's newly established Radon Division in 1986. He is referring to the discovery of extraordinary radon levels found in a Pennsylvania home late in

1984. Stanley Watras, an employee of the Limerick nuclear power plant, then under construction, was setting off alarms as he passed through the new radiation monitors. However, the radiation source could not be linked to his place of work — investigators traced the source to his home in Boyertown, where measurements were as high as 2,700 pCi/L. The Watras family moved out, and six months later returned after assurance by state authorities that the condition had been remediated.

Tests in the surrounding area suggested that several homes had "above acceptable" radon levels, though none nearly as high as the Watras house. EPA and federal Department of Energy officials announced plans to assess radon concentrations and possible health consequences around the country. Preliminary findings in 1986 led the EPA to conclude that 10 percent of the nation's 80 million homes had radon levels above 4 pCi/L.

The EPA's 4 pCi/L marker derived from an earlier regulation concerning homes built over manmade sources of radiation. During the 1950s and '60s, several homes had been built over waste soil from uranium refinement mills in the Southwest. Remediation programs were instituted in the 1970s, after the discovery of elevated radon levels in these homes. In 1983, the EPA declared the 4 pCi/L level to be a remediation objective for the homes, calling the figure an "optimized cost-benefit alternative." When issuing the regulation, the EPA frankly acknowledged that it had made assumptions for which there was no demonstrated evidence. While assuming a linear, nonthreshold dose-effect relationship (that is, the risk of low doses is assumed to be directly proportional to the risk demonstrated at higher doses), the EPA recognized that the data did not preclude "a threshold for some types of damage below which there are no harmful effects."³

Alarms & Uncertainties

IN RETROSPECT, THE 1983 RULING WAS a crossroads for later government policy. The EPA had established the 4 pCi/L

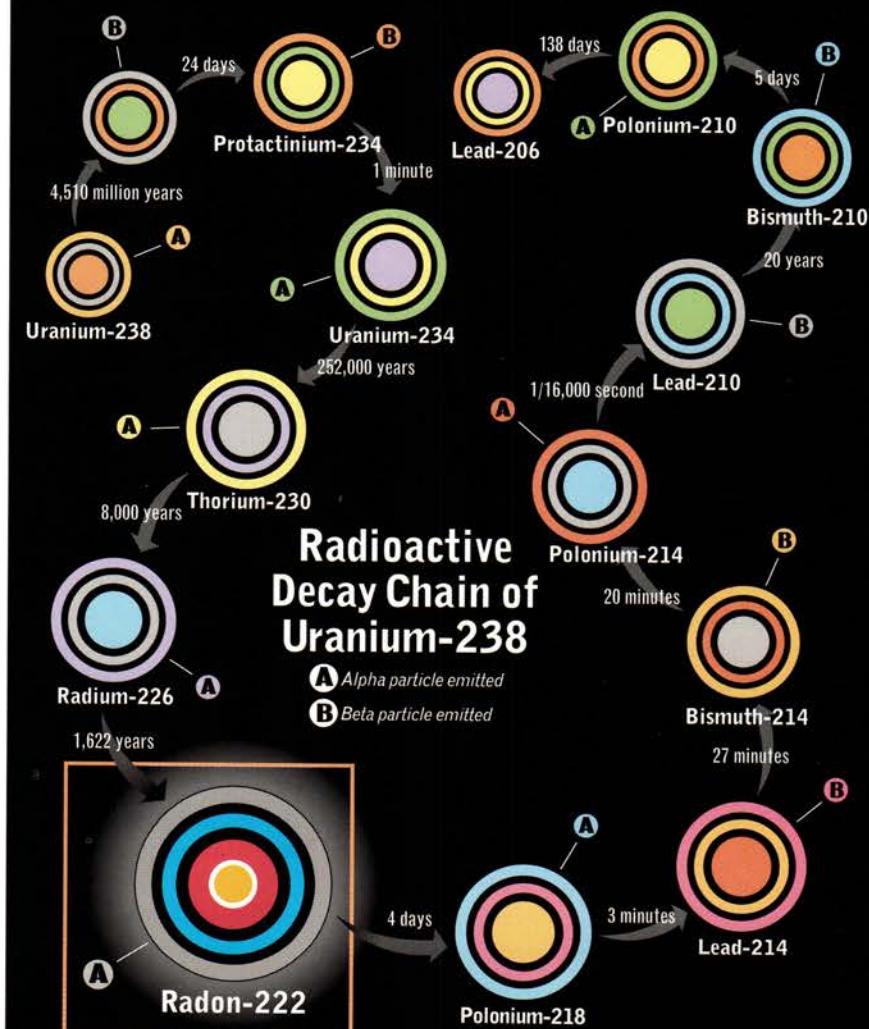
A Radon Primer

Much about radon is well understood. It is a colorless, odorless decay product of radium which lies in the radioactive decay chain that begins with uranium. Although uranium is particularly abundant in granite, shale, and phosphate-bearing formations, small amounts are dispersed throughout the Earth's crust.

Since it is a gas, radon filters through cracks in the bedrock and soil before it finally escapes into the atmosphere. Its half-life (the period during which half the material decomposes) is just 3.8 days. Its decay products, collectively called "progeny," are themselves elements with half-lives ranging from a fraction of a second to 22 years.

When inhaled, radon gas flows quickly in and out of the lungs, almost never lingering long enough to cause damage. But the radon progeny, which are solids, may lodge in the bronchial tree. Here they emit radiation, including alpha particles that may affect the sensitive basal cells lining the bronchi. The alpha particles can damage the DNA in cell nuclei.

Because everyone breathes in radon all the time, some of our lung cells are continuously being damaged. But a cell will commonly repair itself unless the alpha radiation is excessive enough to cause repeated bombardments of the same cell. If cells are extensively damaged by radiation or certain other irritants, they may divide uncontrollably and form a cancerous tumor.



standard for the few houses affected by manmade sources of radiation. A few years later, when addressing the question of indoor radon from natural sources, the agency felt constrained to use the same figure. By the end of the decade, however, two twists in EPA's radon policy had become evident. First, because homeowners were ignoring the agency's advice (fewer than 5 percent of homes had been tested by 1992), the EPA's communications became more aggressive and alarmist.

Describing radon as a "silent killer" and "household intruder," the agency's pamphlets began suggesting that radon levels should be reduced to 2 pCi/L and below. A television advertising campaign resorted to fearful imagery.

Second, the agency never subsequently acknowledged the uncertainty behind its policy assumptions as forthrightly as it did in 1983. Besides questions associated with extrapolations from miner studies (discussed above), there are technical uncertainties involving testing and remediation.

Almost all indoor radon tests are performed for short periods, usually as part of a real-estate transaction. A small canister of activated charcoal is set in place for two to seven days, then sealed, and sent to a laboratory for analysis. While some states have begun to monitor and certify radon technicians, even

when reputable firms are used results can be problematic. A New Jersey study,⁴ for example, revealed serious discrepancies in test results by laboratories that had been approved by the state's Department of Environmental Protection. Three charcoal canisters exposed at the same time in one room gave readings ranging from 6 to 14 pCi/L. The reasons for the discrepancies were unclear. They could have occurred because of lags between time of exposure and laboratory analysis, movement of canisters during exposure period, or errors in measurement.

Nevertheless, when conducted with care and competency, accurate measurements are technically possible. More problematic is whether any short-term measurement can be a proper indicator of risk. Not only do concentrations of the gas often differ in one part of a house from another, but they also vary according to sea-

Frames from the EPA's radon-awareness television campaign: Above, a boy and his dog wear gas masks to thwart the unseen killer at home; below, ambient radon concentrations are compared to hundreds of x-rays.

sons and weather conditions. Outdoor measurements taken throughout the year at single locations have ranged between 0.1 and 0.4 pCi/L. Indoor variations may be far greater. Studies have found that some homes with 10 pCi/L levels in the winter showed just 1 pCi/L in the summer.

A recent study by the N.J. Dept. of Health found that when short-term tests registered higher than EPA's action level of 4pCi/L, long-term averages proved to be lower about 76 percent of the time. When short-term testing was performed in the basement the proportion of "false positives" rose to an astonishing 96 percent. Thus, although a short-term test in the basement might exceed 4pCi/L, actual radon concentrations in the lived-in areas of a home almost always turn out to be under 4pCi/L. Until 1992, the EPA advised that radon tests be con-

ducted in the basement.

In a year-long study, Naomi Harley, a radiation physicist at the New York University School of Medicine, detected a 30-fold difference over time in the readings of a 1988 home that "was constructed to be as 'radon resistant' as possible." Continuous radon monitoring during the year following construction revealed that 2-day measurements in the basement varied between 0.49 and 14 pCi/L. These and similar findings have led to questions about the value of short-term testing for any purpose having to do with safety or risk. In Finland, short-term testing is deemed worthless; authorities require that measurements be taken for at least two months.

The EPA's radon communications to the public exemplify the dilemma. The agency acknowledges that short-term testing may not be a reliable indicator of the average radon level in a home. Its brochures explain that alpha track detectors can be used to measure concentrations over a period of months. Yet the EPA's 1992 Citizen's Guide to Radon tells the public that a couple of short-term tests "may be used to decide whether to fix your home."

Remediation may have its own problems.

Mitigation technology has improved substantially in recent years, but it is still imper-

Not one epidemiological study has thus far confirmed a statistically significant relationship between indoor radon and lung cancer. Nevertheless, the EPA declares that "virtually all scientists agree radon causes thousands of deaths every year."

fect. Even replacing contaminated soil from under and around houses has yielded surprises. Before removal of radioactive landfill from under houses in Grand Junction, Colorado, 71 percent of the houses had radon levels above 6 pCi/L. After cleanup, though some homes with very high readings showed considerable drops, 68 percent still had readings exceeding 6 pCi/L — higher than the EPA's acceptable threshold.

Sealants intended to isolate radon-producing material can deteriorate, requiring continued monitoring. As for ventilation, attempts to enhance air exchange have shown unwelcome consequences. Inappropriately designed ventilation may lower indoor air pressure and actually draw more radon into the home.

The most common mitigation arrangement involves the installation of pipes below the basement floor. These are connected to vertical pipes that extend along the walls of a house. Suction fans near the top of the extension pipes draw the sub-basement air through the piping system for release outdoors. Technical experts generally regard this approach as likely to be successful, with continuous monitoring and assurance that the fans are operating.

However, in 1992, Kenneth Wiggers, owner of a mitigation systems company in Iowa, introduced a new dimension of concern in his paper titled "Cold Climate Radon Mitigation Systems: Opportunities and Perils." The report relates how residents of homes in

which sub-basement systems were installed began to complain of lethargy and short-term memory loss. Mr. Wiggers stopped installing the radon mitigation devices after discovering they were causing backdrafts, drawing gases from furnaces, water heaters, and dryers into the home.

Thus, while radon measurement and remediation are technically achievable, applying them in everyday situations may be more complex than has previously been presented to the public. In the EPA's push to encourage people to become concerned about radon, the benefits of testing and fixing have been made to appear more certain than seems warranted.

Searching for the Epidemiological Answer

NO MATTER WHAT RADIATION THEORY suggests, no matter how sophisticated a risk estimate model may be, the validation of an aggressive management policy should depend on one precept: a demonstrated correlation between lung cancer and residential radon. Determining a radon policy's scientific validity ultimately depends on the results of epidemiological studies. The U.S. Department of Energy and the Commission of European Communities have identified 14 epidemiological studies either in progress or completed.

By late 1993, the conclusions of five studies had been made public. Each was conducted by identifying hundreds of lung-cancer victims and comparing

them with a matching group of people without cancer. Long-term places of residence for the people in the groups were then measured for radon concentrations. Analyses were controlled for certain characteristics including smoking habits, sex, and age.

The five studies were conducted in New Jersey, Sweden, Finland, China, and Canada. The New Jersey study⁵ noted a statistically significant "trend" for increasing risk with increasing radon exposure, but at the same time found that "the relative risk estimate was not statistically significant." A report of the Swedish study⁶ suggested that its risk estimates appeared in the range of those projected for miners. But one of its investigators, John Boice of the U.S. National Cancer Institute, notes that "when adjusting for length of time of occupancy, then the results disappear altogether — the dose-response relationship goes away."

The finding of the China study:⁷ "No association between radon and lung cancer was observed regardless of cigarette-smoking status, except for a non-significant trend among heavy smokers." The study⁸ in Finland concluded: "The present study did not establish the anticipated association between indoor radon exposure and the risk of lung cancer in Finland." The result of the Canadian study:⁹ "After adjusting for cigarette smoking and education, no increase in the relative risk of any of the histologic types of lung cancer observed among cases was detected in relation to cumulative exposure to radon."

¹ The figure is cited by Frank Marcinowski, Radon Division, U.S. EPA, in *Indoor Air Bulletin*, Vol. 3, No. 1, (1993), p.12. ² NCRP Report No. 78, Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States (Bethesda, MD: National Council on Radiation Protection and Measurements, 1984); Committee on the Biological Effects of Ionizing Radiations, National Research Council, Health Effects of Radon and Other Internally Deposited Alpha-Emitters, BEIR IV (Washington, DC: National Academy Press, 1988). ³ "Standards for Remedial Actions at Inactive Uranium Processing Sites," 48 Federal Register, No. 4, 591 (Jan. 5, 1983). ⁴ Bettina Boxall, "8 Tests and 6 Different Measurements," *The Record*, (Hackensack, NJ), May 19, 1986, A-6. ⁵ A Case-Control Study of Radon

and Lung Cancer Among New Jersey Women, Technical Report — Phase I (New Jersey State Department of Health, August 1989). ⁶ Goran Pershagen, et al., "Residential Radon Exposure and Lung Cancer in Swedish Women," *Health Physics*, Vol. 63, No. 2 (August 1992). ⁷ William J. Blot, et al., "Indoor Radon and Lung Cancer in China," *Journal of the National Cancer Institute*, Vol. 82, No. 12 (June 20, 1990). ⁸ Eeva Ruosteenoja, Indoor Radon and Risk of Lung Cancer: An Epidemiological Study in Finland, Finnish Center for Radiation and Nuclear Safety (Helsinki: Finnish Government Printing Center, 1991). ⁹ E.G. Letourneau, "A Case-Control Study of Residential Radon and Lung Cancer in Winnipeg, Manitoba" accepted for publication in *American Journal of Epidemiology*.

Thus, a few investigations have at best shown ambiguous results. But not one epidemiological study has thus far confirmed a statistically significant relationship between indoor radon and lung cancer. [As this article went to press, a Swedish investigation reported a statistically significant relationship among smokers, but not among people who never smoked. The study also acknowledged "substantial uncertainty in the estimation of exposure to radon in the study subjects."] Either there is no relationship or the numbers of subjects in the studies were not high enough to provide adequate statistical power to show a correlation. Nevertheless, EPA's communications to the public ignore these uncertainties and declare that "virtually all scientists ... agree with estimates that radon causes thousands of preventable lung cancer deaths every year."

Politics vs. Prudence

THE NATION'S AGGRESSIVE RADON POLICY has been driven in part by the unique opportunity that the gas presents to political and regulatory officials. Unlike most environmental hazards, radon is largely a natural phenomenon with no industry to blame for its presence. Moreover, present policy urges that homeowners pay for testing and fixing out of their own pockets. The financial cost to the government is negligible, and "protecting" homeowners against the gas has been more politically convenient than for other alleged hazards. The absence of an industrial "culprit" means the absence of an interested party who might be expected to underscore the uncertainties about the issue. This has made it easier for political and regulatory leaders to push aggressive policies of questionable warrant. For public officials, radon is environmen-

talism on the cheap.

In 1992, the U.S. Senate voted 82 to 6 for a bill that would require radon testing in every school in the nation. The bill also defined as a "priority radon area" any area in the nation where average indoor levels likely exceed the national average "by more than a *de minimis* amount" (a term, used in legal texts, which means "trifling amount"). The average indoor radon concentration is about 1.3 pCi/L, well below the existing action level of 4 pCi/L. By the EPA's account, the new provision would mean that one-third of the country is at high risk. A Department of Energy memorandum doubled the EPA's estimate to two-thirds of the nation, and said the bill would cost homeowners \$50 billion.

The 1992 congressional session ended before the House could vote on radon legislation, so the Senate's provisions are not yet law. But bills are now making their way through both Houses of Congress that would require that every school and federal building be tested for radon, and that every home sale involving federal financial backing include a radon test. (About 10 percent of homes in the nation are backed by federal funds.) Another provision mandates that before purchasing, every potential buyer would have 10 days to demand that the home be tested for radon.

The momentum in Congress has been toward promoting aggressive action against radon, all to be paid for by homeowners or local authorities, and all based on uncertain science. A prudent approach would signal less urgency. The radon risk model used by the EPA assumes an individual will spend 75 percent of his time in the same home during a lifetime of 70 years. Even if the agency's worst expectations about low-

level exposure are eventually confirmed, delaying action for a few years would have little impact on anyone's lifetime risk. More epidemiological studies are expected to be completed in the next four or five years.

If any policy is called for in the meanwhile, it might be to locate the relatively few homes with very high radon concentrations. Were EPA's action level not 4 pCi/L but 20, as is the standard in Canada, the number of "unsafe" homes that EPA presumes need remediation would drop dramatically. Instead of 6 to 8 million homes, the figure would be about 50,000. The cost of finding and remediating these homes would be measured in millions of dollars rather than the billions called for by present policy.

In the summer of 1993, the *Radon Bulletin*, a publication by state radon program directors in cooperation with the EPA, suggested ways to attract media attention during National Radon Action Week in October. Some were unexceptional, like issuing a press release and promoting a neighborhood radon exhibit. But others included: "Place a photo of local football players in the newspaper wearing radon tattoos that certify they have tested their homes;" and "Go on a hunger strike until 10,000 homes are tested in your area."

By making such bizarre suggestions, the authorities take a large political risk. They expose themselves to ridicule that could undermine the intended seriousness of their advice concerning radon. If the current radon policy ultimately proves unwarranted, the public understandably may become resentful. The wasted billions and unnecessary anxiety can only translate into further cynicism about public officials.

Homeowners pay for testing and fixing out of their own pockets. The financial cost to government and industry is negligible, and "protecting" homeowners against the gas is politically convenient. For public officials, radon is environmentalism on the cheap.

RADON RISKS ARE REAL

THE EPA ANSWERS LEONARD COLE

In a search for perfect certainty in an imperfect world, the author suggests a standard for action that could not be met by most public health efforts.

LEONARD COLE ARGUES THAT THE ENVIRONMENTAL Protection Agency's radon policy is too aggressive, considering the strength of the scientific evidence. Either Cole doesn't fully understand radon science or he is writing to a conclusion that validates his personal opinion. As with any public health issue, it is legitimate to ask whether we know enough to recommend action. However, the answer requires more than a layman's examination of complex science, public health policy, and communications issues.

First, let's be clear about EPA's recommendations on radon. We recommend that people spend as little as \$20 to test their homes for radon. Second, we suggest that those who find elevated levels (about 6% of homes) spend about \$1,200 to reduce their radon levels below the EPA voluntary action level of 4 picocuries per liter (pCi/L). This cost is in the range of many other household repairs including fixing a leaky basement, replacing a roof, or painting. The recommendations are voluntary. People can decide if they want to test and, if necessary, fix their home. Even in real-estate transactions, there are no federal or state laws requiring radon testing and/or fixing.

Radon Science

RADON SCIENCE IS BASED ON SEVERAL EXTENSIVE studies by expert national and international organizations including the National Academy of Sciences (NAS),¹ the National Council on Radiation Protection (NCRP),² the International Commission on Radiation Protection (ICRP),³ the World Health Organization (WHO),⁴ the Centers for

Disease Control (CDC),⁵ the EPA Science Advisory Board,⁶ and many others. The consensus of these organizations is that radon causes lung cancer in humans — not just in animals. They also agree that a "linear no-threshold" approach can be used to estimate radon risks. A no-threshold approach recognizes that radiation may carry risks at low levels of exposure. While research is underway to explore the possibility of a threshold, linear no-threshold approaches are commonly used in developing guidelines to protect people from many kinds of radiation, including exposures from nuclear power plants and x-rays.

Cole's description of epidemiological studies is superficial. The NAS and others agree that the epidemiological studies of miners can be applied to residences, with certain adjustments recommended by NAS which EPA has already made. (See NAS, Comparative Dosimetry of Radon in Mines and Homes, 1991.) Although many of the miners were exposed to extremely elevated levels, some of these studies show: 1) statistically significant increases in lung cancers for miners whose cumulative exposures are equivalent to a lifetime exposure at 4 pCi/L; 2) statistically significant increases in lung cancer for both smokers and non-smokers.

Cole also argues that there may be no correlation between residential radon exposure and lung cancer because the results of residential epidemiological radon studies are ambiguous. Granger Morgan of Carnegie Mellon



By Stephen Page

University⁷ recently criticized Cole on this point:

"In describing the science involved in assessing the risks of indoor exposure to radon, Cole frequently refers to negative epidemiological studies. Unfortunately, he does not systematically explore the problems of designing a study to detect radon-induced lung cancer in the general population. Thus, the reader is left unable to judge which, if any, of these studies provide important evidence about risk, and which lack adequate power to be informative."⁸

Many expert scientific groups have sorted through all these studies. In fact, radon is one of the most extensively studied pollutants in the world, with strong evidence of its link to lung cancer — stronger than evidence for many other factors linked to cancer. One example is high dietary fat. Scientists still cannot conclusively demonstrate the link between high dietary fat and colon cancer or heart disease. Yet, considering the evidence, low fat diets and screening tests are recommended for the public.

Using Cole's logic, we wouldn't take any action to prevent heart disease or colon cancer until the exact linkages to diet are irrefutable. For example, Cole believes that action on radon levels below 20 pCi/L should be delayed until the residential evidence is irrefutable. This inaction would lead to many needless lung-cancer deaths.

Yes, there are uncertainties about radon risks. But the uncertainties relate to the exact number of lung cancers that result from radon exposure, not whether radon exposure increases

the risk for lung cancer. Contrary to Cole's assertion, EPA has clearly and publicly outlined radon health-risk uncertainties.

The *Citizens Guide to Radon*, EPA's major consumer publication on radon, specifically mentions uncertainty about the magnitude of radon risks. The Guide also suggests that consumers may contact their state radon offices to obtain a copy of the EPA Technical Support Document⁹ underlying the Citizen's Guide. This document includes a 41-page chapter outlining how EPA's radon risk estimates were developed and the uncertainties associated with them.

In a search for perfect certainty in an imperfect world, Cole suggests a standard for action that could not be met by most public health and environmental efforts. While radon is classified as a "known" human carcinogen, the question is not whether uncertainty exists — it always does; the question is how to deal responsibly with both the certainty and the uncertainty.

Radon Policy

PUBLIC POLICY IS DEVELOPED BY TAKING what you know and don't know from the science and weighing options. Any national policy, regulatory or voluntary, such as requiring seat belts for cars or discouraging smoking or radon, must consider the costs and benefits to society.

Cole argues the EPA's 4 pCi/L action level is too low and that 20 pCi/L would be better. From a health-risk perspective, there is no basis for selecting 20 pCi/L. Ninety-nine percent of the risk occurs among people who are

exposed to radon levels below 20 pCi/L.¹⁰ Because there is no evidence supporting a "safe" level of radon, it is best to reduce radon exposure when possible. Therefore, the effectiveness of reduction technologies becomes a significant factor in determining a radon action level. Research shows that current technology can reduce radon levels in homes consistently below 4 pCi/L. From the standpoint of costs, EPA's 4 pCi/L radon action level results in a cost-per-life-saved ratio that compares well with other federal health and environmental programs.

Cole's discussion of international radon-action levels is also lacking. He fails to mention that many other Western countries such as Germany and Ireland have action levels ranging from 3 to 10 pCi/L. Canada's action level of 20 pCi/L cited by Cole is the exception rather than the rule. The trend in other European countries is to lower action levels — like Great Britain's recent downward move to 5 pCi/L.

Cole also states that we should concentrate solely in high-risk areas. While EPA is targeting its efforts to reduce radon risks, this approach should supplement, not supplant, a nationwide risk-reduction strategy. Many homes with elevated radon levels are situated outside of "high risk" areas. An effort to find all the homes over 20 pCi/L would still require a large-scale, multi-state testing program. It would also leave many homes with significant radon risks undiscovered. The only way to find homes with high radon levels is to test them, and that's why EPA rec-

ommends that all homes below the third floor be tested.

In his zeal to sound alarms about radon testing and mitigation accuracy, Cole tells only part of the story. Radon test-device accuracy has been identified by experts, including Dr. Genevieve Matanoski, professor of epidemiology at Johns Hopkins University and chair of the EPA Science Advisory Board, as comparable to and in some cases better than medical screening tests such as mammograms and pap smears. Also, the "backdrafting" issue raised by Cole is well understood and is addressed in EPA's technical training courses for radon contractors.¹¹

Risk Communication

COLE ACCUSES EPA OF USING AGGRESSIVE APPROACHES TO RADON COMMUNICATIONS. Ironically, risk-communication experts criticized EPA's initial radon public-information materials as too lengthy, and riddled with excessive scientific and technical information. The materials did not provide the prescriptive guidance that risk-communication studies show the public wants.

Communication experts advised EPA to provide clear, specific guidance for the public (such as "test your home for radon") grounded in decades of experience in communicating other health risks such as cigarette smoking. For instance, communications experts note that while scientific research shows that smoking 20 cigarettes a day is worse than smoking 4 cigarettes a day, government anti-smoking programs do not get into the relative risks of 4 versus 20 cigarettes.

¹ Health Risks of Radon and Other Internally Deposited Alpha Emitters (BEIR IV), National Academy of Sciences, National Research Council, Report of the Committee on the Biological Effects of Ionizing Radiation, National Academy Press, Washington, D.C., 1988; and Comparative Dosimetry of Radon in Mines and Homes, National Academy of Sciences, National Academy Press, Washington, D.C., 1991. ² Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States, National Council on Radiation Protection and Measurements (NCRP), NCRP Report No. 78, Bethesda, Maryland, 1984. ³ Lung Cancer Risk from Environmental Exposures to Radon Daughters, International Commission on Radiological Protection (ICRP), ICRP Publication No. 50, Oxford, Pergamon Press, 1987. ⁴ Man-Made Mineral Fibers and Radon, World Health Organization International Agency for Research on Cancer, Monograph on the Evaluation of Carcinogenic Risks to Humans, Vol 43, WHO/IARC, 1988; and Indoor Air Quality: A Risk-based Approach to Health Criteria for Radon Indoors — Summary Report on WHO Working Group, WHO Regional Office for Europe, Copenhagen, 1993. ⁵ Testimony of Vernon Houk, M.D., Assistant Surgeon General, Director, National Center for Environmental Health, Centers for Disease Control, before the Subcommittee on Superfund, Ocean, and Water Protection, Committee on Environmental and Public Works, U.S. Senate, May 23, 1990; and testimony of Stephen B. Thacker, M.D., Assistant Surgeon General, Director, National Center for Envi-

ronmental Health, Centers for Disease Control, before the Subcommittee on Transportation and Hazardous Materials and the Subcommittee on Health and the Environment Joint Legislative Hearing on HR 2448, The Radon Awareness and Disclosure Act of 1993, U.S. House of Representatives, July 14, 1993. ⁶ "Revised Risk Estimates and Associated Uncertainties," from Raymond Loehr (Chairman, EPA Science Advisory Board) and Oddvar Nygaard (Chairman, SAB Radiation Advisory Committee) to EPA Administrator William K. Reilly, January 9, 1992. ⁷ M. Granger Morgan is head of the Department of Engineering and Public Policy at Carnegie Mellon University. "Much of his research has involved issues of risk analysis and risk communication for which the technical details are of central importance." (*Chemical & Engineering News*, see footnote 8 below.) ⁸ "Managing Risks from Indoor Radon," a review of Leonard Cole's book *Elements of Risk: The Politics of Radon* (1993), in *Chemical & Engineering News*, October 11, 1993, p. 35. ⁹ Technical Support Document for the 1992 Citizen's Guide to Radon, United States Environmental Protection Agency (Office of Air and Radiation (EPA 400-R-92-011)), May 1992. ¹⁰ National Residential Radon Survey, United States Environmental Protection Agency (USEPA), Office of Air and Radiation (EPA 402-R-92-011). ¹¹ Technical Support Document for the 1992 Citizen's Guide to Radon, United States Environmental Protection Agency (USEPA), Office of Air and Radiation (EPA 400-R-92-011), May 1992.

Instead, these programs focus on prescriptive messages such as "don't smoke."

Current versions of EPA's outreach materials are more prescriptive, but according to Cole are now "too alarmist." This is Cole's opinion. Let's look at the facts. Other public-service campaigns, such as the anti-drug and anti-drunk driving campaigns, have used powerful and emotional messages to persuade people to take actions to reduce health risks. One need only remember the comparison of a frying egg to a brain on drugs, or skeletons depicting people who die from drunk driving, to know that powerful and emotional messages are commonly used to encourage people to change their behavior — and maybe save a life.

Extensive consumer focus group studies that are routinely used to evaluate EPA radon pamphlets and advertisements provide empirical proof that people are not alarmed by EPA radon materials. In fact, EPA's use of powerful messages, combined with humor, have resulted in some of the highest consumer attention, comprehension, and recall scores in the communications industry.

Cole's opening paragraph describes one of EPA's more recent radon brochures. The cover shows a cartoon family holding their breath — an obviously humorous strategy for addressing the radon problem. Turn the page and the brochure reveals a more practical strategy for addressing radon: a radon test kit.

Cole's melodramatic portrayal of this cartoon family shows that either he simply doesn't get the humor, or his biases on this subject make him unwilling to acknowledge the diversity of approaches being used to communicate about radon. You decide. I invite readers to call the National Safety Council toll free radon hotline at (800-767-7236) to get a free copy of this brochure.

Mr. Page is the director of the federal Environmental Protection Agency's Radon Division.

Leonard Cole Responds:

AMONG OTHER REGRETTABLE INNUENDOES, STEPHEN PAGE SUGGESTS THAT I don't "fully understand" radon science and that radon issues are too complex for a "layman" to address. Elsewhere, an EPA radon official dismisses scientific critics as a fringe group with "outlying opinions."¹ Casting aspersions, in my judgement, is not the way EPA should be trying to defend policy.

My fundamental theme is that the public deserves to be informed about the range of views concerning radon. This includes uncertainties about the risk of exposure to low concentrations of the gas, about the values of short-term testing, and more. In its communications to the public, EPA virtually ignores the uncertainties. The very institutions that Page cites to justify EPA's aggressive policy actually confirm the significance of the uncertainties I recount.

The National Academy of Sciences' report on radon "acknowledges that the total uncertainty in its risk estimates is large."² The National Council on Radiation Protection and Measurements developed a model to predict lung cancer among miners, but said "it is not known whether extrapolation to environmental levels is valid."³ The International Commission on Radiation Protection underscores the uncertainty about radon policy by advising that appropriate action levels can be anywhere from 5 pCi/L to 16 pCi/L.

Indeed, members of EPA's Science Advisory Board, a group of experts from outside the agency, have themselves criticized EPA's radon policy. Michael Reimer, a scientist with the U.S. Geological Survey, questions the value of EPA's call for every home to be tested, and he deplores EPA's scare-tactics to rouse the public. Another member of the advisory board, Richard Sextro, a physicist at Lawrence Berkeley Laboratory, has also expressed unhappiness with the agency's alarmist advertising campaign. While he does not quarrel with EPA's action level, he strongly opposes the agency's allowance for short-term radon testing because it frequently misrepresents long-term average concentrations. Jan Stolwijk, a Yale professor of epidemiology and public health, was dropped from EPA's Science Advisory Board altogether. He believes his departure was prompted by his pointed objections to the agency's aggressive radon policy, including its 4 pCi/L action level.

Other distinguished scientists have publicly taken issue with EPA's aggressive policy. Among them are many of the world's leading radon experts including Anthony Nero of Lawrence Berkeley Laboratory, Naomi Harley of New York University Medical School, Bernard Cohen of the University of Pittsburgh, Antone Brooks of Pacific Northwest Laboratories, William Nazaroff of the University of California at Berkeley, Keith Schiager of the University of Utah's Radiological Health Department, Susan Rose of the Department of Energy, Kenneth Mossman, president of the Health Physics Society, Ernest Letourneau, director of Canada's Radiation Protection Bureau, Geno Saccamano of St. Mary's Hospital in Grand Junction, Co., and William Mills, a former division director in EPA's Office of Radiation Programs. To portray these scientists and others with similar views as part of a fringe, or as not understanding the issues, is preposterous.

Reimer dismisses the notion that critics of EPA's policy hold outlying opinions: "Most critics, including myself, are trying to help the EPA develop a better policy. The EPA does not help itself or the country by attacking them." Amen.

¹ See Feb. 27, 1991 letter by Margo Oge, formerly director, EPA Radon Division, currently director, EPA Office of Radiation and Indoor Air Programs, in *Element of Risk: The Politics of Radon*, p. 212. ² Committee on the Biological Effects of Ionizing Radiations (BEIR IV), p. 47. ³ NCRP Report No. 78, p. 4.

"YOU HOLD IN YOUR HANDS, I SINCERELY BELIEVE, ONE OF THE MOST IMPORTANT DOCUMENTS IN conservation history... It is a bold attempt to grope our way back to October 1492, and find a different trail, a trail overgrown and nearly forgotten. We seek not the broad highway that leads to gold, empire, and death... What we seek is a path that leads to beauty, abundance, wholeness, and wildness. We look for the big outside instead of empire, we seek wolf tracks instead of gold, we crave life rather than death." ♦ So begins the introduction to a special issue of the journal *Wild Earth*,¹ penned by Dave Foreman, heralding an audacious, visionary plan to return millions of acres throughout North America to wilderness. Foreman heads a small but growing band of environmentalists and field biologists who aim to put the brakes on centuries-old attitudes toward land use and exploitation. With their plan, the North American Wilderness Recovery Project (a.k.a. the Wildlands Proposal), they would return big, charismatic species such as buffalo, grizzly bears, elk, wolves, and puma to their pre-Columbian haunts. They would restore a true spirit of wilder-

NO MAN'S LAND

Earth First! founder DAVE FOREMAN launches a wild plan for transforming millions of acres throughout North America into wilderness — and eminent biologists back him up.

ness — the "big outside" — to the American landscape. ♦ Their proposal calls for the restoration of whole landscapes and the creation of a vast system of connected wilderness reserves that would crisscross the continent. These reserves would dwarf the largest national parks. Rather than build roads, laborers would remove existing ones, along with dams, power lines, and other human-made structures. Planners would choose the reserve sites with plants and animals, not people, in mind, selecting them not for recreational opportunities but for their ecological potential. Up to half the contiguous United States would be involved in a transformation whereby "islands" of civilization would be surrounded by wilderness tracts and corridors. ♦ "We live for the day when grizzlies in Chihuahua have an unbroken connection to grizzlies in Alaska," reads the Wildlands mission statement, "when gray wolf populations are continuous from New Mexico to Greenland; when vast, unbroken forests and flowing plains again thrive and support pre-Columbian populations

BY ELIZABETH PENNISI

photographs by Patrick Harbron





of plants and animals."

Says Dave Foreman: "Our goal is to create a new political reality based on the needs of other species."

Make It Wild

AT FIRST READING, THE WILDLANDS PROPOSAL seems too wild to warrant consideration by practical people (environmentalists included). But the document's details strive to meld the "passion of those who love wild things" with the "scientific rationality of those who study wild things." Consequently, or perhaps coincidentally, the proposal's scientific underpinnings dovetail with new research currently reshaping conservation science. A growing number of ecologists and conservation biologists are beginning to support the assumptions underlying Wildlands' radical goals, even if they do not support the document itself.

"It's viewed as an extreme proposal, [but] it proposes a new attitude toward Nature that a lot of us believe in," says Sara Vickerman, who nevertheless finds the idea politically impractical. (Vickerman coordinates activities in Portland, Ore., for Defenders of Wildlife, an environmental organization.) "Just stopping destructive projects is not enough."

The Wildlands proposal arose because of the shortcomings of current conservation efforts, its creators argue. Until recently, most conservation strategies set aside natural areas to protect particular threatened plants and animals. Landscapes also became protected because of their natural beauty, yet little mind was paid to the site's relevance to biological diversity.

Ecologists are realizing that effective conservation entails saving not one but many species, and doing so in their natural environments. Conservationists should be taking a broader view that encompasses large-scale preservation of habitats and ecosystems, argues Michael Soulé, a conservation biologist at the University of California-Santa Cruz, and a co-author of the proposal. Like other Wildlands proponents, he urges the United States, actually all of

North America, to go even further and restore a sense of "wildness" and "fierceness" to the land.

The creators of this macho plan emphasize that they are basically providing a framework to make it easier for local groups to carry out conservation strategies which would truly protect entire ecosystems. Indeed, other large-scale planning efforts are already underway which embody many of the basic Wildlands tenets, Soulé says.

This doesn't placate the plan's critics, who fault Wildlands as unrealistic, incomplete, and too "eco-centric." Foreman's argument that people must accommodate the needs of other species first has prompted some to chastise Wildlands' creators as being anti-human. Even arch-supporters of conservation and the protection of biological diversity note that Wildlands' rhetoric glosses over political realities and economic constraints. The plan offers no detailed pro-

visions for implementing its vision, for compensating people whose livelihoods are at stake, or for restoring landscapes.

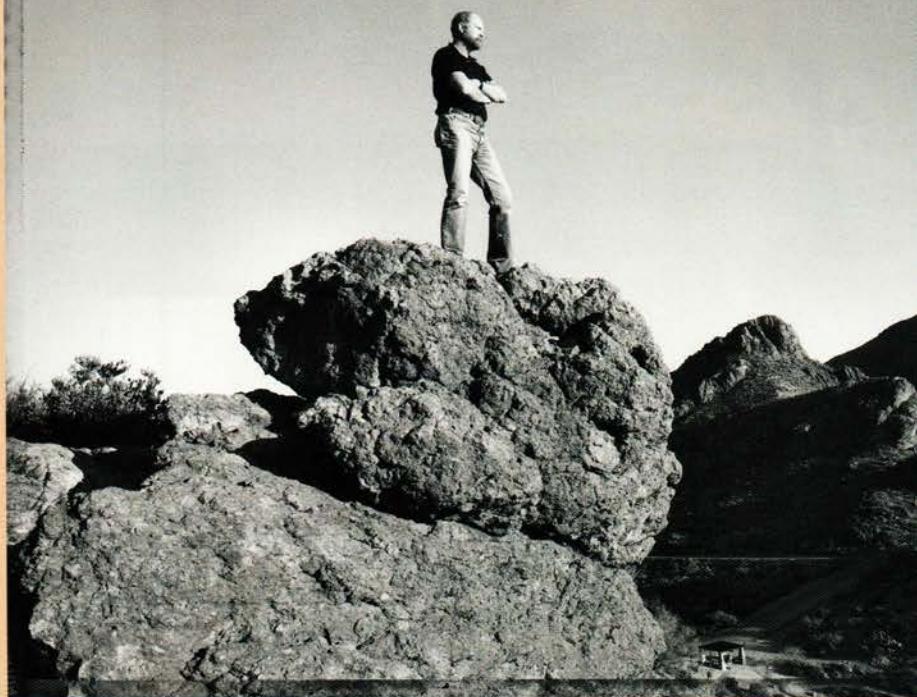
"It certainly is justifiable scientifically," says Peter F. Brussard, a conservation biologist at the University of Nevada at Reno. "But [this kind of idea] scares the pants off everybody in Nevada. Things like gays in the military pale in comparison."

Skeptics note that few if any large tracts of land have survived as pristine ecosystems with the same species diversity that existed before Columbus landed in North America. So restoration of habitats and species — a fledgling science at best — will also require much more study and funding. Yet the proposal does not discuss who will finance the acquisition, restoration, or continued preservation of this land, or how the acquisition of land will overcome economic constraints and personal values.

"It's a fascinating, powerful, and

**"THIS IS A BOLD ATTEMPT TO GROW UP,
FIND A DIFFERENT TRAIL, A TRAIL OF
OUR OWN."**

Dave Foreman at home in the Arizona desert



provocative visionary document," says Deborah Jensen, director of conservation science and stewardship at the Nature Conservancy in Arlington, Va. "But it's not an operational prescription."

The Wildlands' creators counter that the plan's time-frame stretches decades, even centuries, allowing people to shift gradually their homes, jobs, and values so as to be more in line with Wildlands thinking. "When you talk about that [time] scale, things that seem very unreasonable become less so," says Reed F. Noss, a conservation biologist based in Corvallis, Oregon, who helped write the Wildlands document. He thinks this long-term view will make possible compromises that will ease concern about issues of equity, the rights of property owners, and of how and what should be set aside. Unless people recognize that the Wildlands strategy is long-range, says Noss, the plan might appear "hopelessly utopian."

Even so, many observers are taken aback by this wild vision for saving species. "[Wildlands]," concludes Sara Vickerman, "really makes the rest of us [environmentalists] look reasonable."

Current Conservation Plans: Fatal to Threatened Species?

IS THE WILDLANDS PROJECT TOO WILD AN Idea? Not if Americans are serious about its stated goals of saving wilderness and species. Fast, expensive, emergency room efforts to save endangered species are clearly inadequate, says J. Michael Scott, a conservation biologist with the U.S. Fish and Wildlife Service at the University of Idaho in Moscow. Scott's analysis of species-recovery plans set forth under the 1973 Endangered Species Act found the strategies "risk extinction rather than ensure survival."² According to his measures, even if threatened species were restored to population levels deemed "viable" by the

Endangered Species Act, 60% of these species "would remain in peril" due to extreme loss of habitat; currently, about 28 to 37% of endangered species are being "managed for extinction" because recovery goals are insufficient to produce self-sustaining populations.

"Conservation activities need to be pro-active rather than re-active," says Scott. That context preserves not just one kind of organism, but whole native ecosystems of every kind, with complete food webs.

To save threatened species, several international conservation organizations³ suggest that 10 to 12% of a country's land area should be set aside for protection. Reed Noss counters that native ecosystems "of every kind" are unlikely to persist under such conditions. In an article published in *Natural Areas Journal*, he estimates that 50% of a region's land area "is what it takes to represent all major vegetation types, maintain viable populations of large carnivores, and have at least some landscapes where natural-disturbance regimes remain unimpeded."

Many people do not realize that the seemingly vast expanses of undeveloped or protected land in the continental United States still leave many of North America's ecosystems vulnerable, says Dave Foreman. These protected areas include just 60% of the continent's ecosystems; only 19% of North American ecosystems exist in preserves larger than 100,000 hectares — a block of land roughly 20 miles on each side. Noss adds that domestic animals graze on one-third of federal "wilderness" lands, altering the naturalness of these areas.

Protecting rare and endangered species remains crucial, says Noss. But protection must extend to large carnivores such as grizzly bears, wolves, and wolverines. Returning these "umbrella species" to their former ranges means setting aside enough land to guarantee the preservation of other species and natural processes. These processes include elements critical not only to the carnivores' survival, but the survival of people as well: the cycling of nutrients and

OUR WAY BACK TO OCTOBER 1492, AND GROWN AND NEARLY FORGOTTEN."



FINDING THE VULNERABLE GAPS

WITH THE WILDLANDS PROJECT, EARTH FIRST! FOUNDER DAVE FOREMAN AND HIS scientific entourage make a grand gesture which they hope inspires others to do large-scale conservation planning. With "gap analysis," J. Michael Scott is supplying the data that makes this planning possible. * Gap analysis is a method for assessing species diversity, distribution, and vulnerability on a state-wide basis. Though at first considered a radical conservation strategy, this process is now used by about 30 states to inventory their flora and fauna. Already, the technique is helping planners protect species in ways compatible with human land-use needs. * Presently a U.S. Fish and Wildlife Service biologist based at the University of Idaho in Moscow, Scott first realized the need for this type of species assessment while tracking the fate of forest birds in Hawaii. There, he discovered that too few of these endangered birds dwell in protected reserves. He decided to try and identify vulnerable but valuable areas — the gaps — which should become protected habitat. * A few years later, his work with the recovery program for the California condor made apparent to him the benefits of plugging the gaps in a conservation protective network for both rare species and plentiful ones. Despite all-out efforts by biologists and from \$15 to \$30 million in funding (including land acquisition) to save it, only nine condors survive in the wild. * "The time to protect a species is when it's common," Scott concludes. He is convinced that practicing preventive conservation betters the costly, and sometimes fruitless, task of stopping extinction once a species' numbers have dwindled to a precious few. * Scott begins a gap analysis by having a computer overlay different kinds of geographic information onto a state map. The addition of this data, from vegetation types to population-growth projections, can graphically convey the status of entire biotic communities, including human components. * Researchers use remote sensing data and existing vegetation maps to mark off the different tree, shrub, or grass communities — vegetation "types" defined by the United Nations Educational, Scientific, and Cultural Organization. Depending on the topography, these types tend to occur in conjunction with particular animals. By combining vegetation data and geographic information, scientists can deduce the type of habitat and, from that, the animals which live there. * Researchers then plot the known distributions of vertebrates in the state. In addition, the computer calculates species populations by overlaying all the data about individual species to see where most of them live. Finally, the computer maps land-use information to indicate areas that are protected or scheduled for development. The results pinpoint rare species, vegetation types that are unprotected, and areas rich in biological diversity but vulnerable to the bulldozers. * Under the auspices of the U.S. Fish and Wildlife Service, and with help from the Nature Conservancy's Heritage Program and local experts, Scott and his colleagues are providing information that will enable scientists and government planners to make decisions that satisfy the needs of plants and animals, as well as of people. * "We're thinking boldly," says Scott. "But we pale in comparison to Wildlands."

water, succession of species, and energy flow through food chains, for example. Only reserves large enough to contain variations in the landscape will both allow natural selection to occur and enable organisms to adjust to climate or other changes.

Existing parks, wildlife refuges, and sanctuaries are too small, too isolated, and too fragmented to meet these needs. For example, every 200 to 300 years, great fires destroy lodgepole pine forests that characterize Yellowstone National Park. Only by preserving forest stands throughout a much larger region, known as the Greater Yellowstone Ecosystem, could such natural events occur without threatening to destroy biodiversity, says Noss.

To establish protected open spaces, the Wildlands plan calls for establishing "core" reserves off-limits to most human activity and stripped of almost all human artifacts. Roads top the list: They provide exotic species with easy entry to new habitats and unnecessarily cut ecosystems into smaller and more vulnerable fragments. To curtail poaching and other damaging activities, the Wildlands proposal suggests that core areas should contain no more than one-half mile of road per square mile of land.

Wildlife "corridors," thin strips of forest, would connect large chunks of wilderness, effectively expanding the potential ranges of each area's inhabitants. Buffer zones, in which limited human activity could occur, would surround the cores and their corridors, insulating them from the detrimental effects of cities and suburbs.

Studies that monitored the movements of grizzly bears in Canada indicate that just 50 bears require about 12 million acres. Often it takes hundreds of individuals to ensure a species will persist many decades, says biologist Reed Noss. One thousand grizzlies would need 242 million acres — extents of land possible only through refuges connected by corridors. Linking the Greater Yellowstone Ecosystem with the Northern Rockies (the Northern Continental Divide Ecosystem) and then again with the Cana-

VANISHING OPEN SPACE



ONLY RESERVES LARGE ENOUGH TO CONTAIN VARIATIONS IN THE LANDSCAPE WILL BOTH ALLOW NATURAL SELECTION TO OCCUR AND ENABLE ORGANISMS TO ADJUST TO CLIMATE AND OTHER CHANGES. EXISTING PARKS, WILDLIFE REFUGES, AND SANCTUARIES ARE TOO SMALL, TOO ISOLATED, AND TOO FRAGMENTED TO MEET THESE NEEDS.

dian Rockies could create such a system.

Some scientists question these numbers. "It's certainly true we need large areas," says the Nature Conservancy's Deborah Jensen. "It's certainly true that these large areas need some kinds of protection. The question is how much of each?"

"[The answer] is not obvious," adds Lynn A. Maguire, a conservation biologist from Duke University in Durham, N.C. She questions not only how much space carnivores require, but also the notion that this space needs to be wilderness as defined by Wildlands' proponents.

The concept of restoring entire

ecosystems to a "pristine" state also stands on thin science. Very little of the United States still hosts the same species diversity that existed before Columbus discovered North America. Even then, the "wilderness" had already been affected by American Indians who, for instance, set prairie fires for buffalo hunting and warfare.

In his *Natural Areas Journal* article, Reed Noss opines that returning lands to some pristine natural condition in most cases is "neither responsible nor desirable because the physical and biotic environment are different now from when these systems evolved."

"The most important thing to understand about the strategy proposed here is that it is a long-range plan," writes Noss. "Restoration takes time."

Biologists Back Wildlands

OTHERS, HOWEVER, DO NOT FIND THIS PROPOSAL TOO FLAWED TO WARRANT SERIOUS CONSIDERATION. Wildlands drew strong applause from participants at the annual meeting of the Society for Conservation Biology this past June when it was presented by Foreman, Soulé, and Noss. The shortcomings of existing species-preservation projects make a broader approach — to protect environments so that species

THE PROPOSAL'S SCIENTIFIC UNDERPINNINGS DOVETAIL WITH NEW RESEARCH CURRENTLY RESHAPING CONSERVATION SCIENCE. A GROWING NUMBER OF ECOLOGISTS ARE SUPPORTING THE ASSUMPTIONS UNDERLYING WILDLANDS' RADICAL GOALS, EVEN IF THEY DO NOT SUPPORT THE DOCUMENT ITSELF.

will never become threatened — quite appealing to some field scientists.

"It's no longer enough to save one wetland here and a prairie there," says Frank J. Popper, a land-use planner at Rutgers University in New Brunswick, N.J. "You need to do conservation regionally."

Six years ago Popper and his wife, geographer Deborah E. Popper of Rutgers and of New York University, suggested that 139,000 square miles across ten Great Plains states be transformed into a "buffalo commons." They proposed allowing marginal, bankrupt farmland to return to natural habitat. When the Poppers first suggested this idea, many feared they wanted to kick people off the land. But the East Coast academics say they are simply advocating that people use the land in ways that are more compatible with the terrain and climate.

Now, driven by economic at least as much as by conservation motives, the transformation of cattle ranches and even some farms into buffalo reserves has begun. "People are actually leaving because of economic difficulties," says Frank Popper. Those staying are eyeing buffalo harvests and tourism as new ways to help make ends meet.

Economic trends in other regions of the country are aligning with some of the goals outlined in the Wildlands proposal. For reasons independent of environmental concerns, extractive industries such as mining, logging, and cattle grazing are a shrinking part of a growing Western economy, argues Thomas M. Power, an economist at the Univer-

sity of Montana in Missoula. Today, most of the people living in Western states reside in a few urban areas and value the landscape for its scenery and recreational opportunities, not for its extractable resources. "Environmental quality is [the West's] primary economic and social resource," he says.

W. Ed Whitelaw, an economist at the University of Oregon in Eugene, equates a clean environment with a "second paycheck." People content with their surroundings are less likely to move away or demand the higher salaries of equivalent jobs in less desirable communities, he says. Moreover, cities such as Portland, Ore., have accumulated evidence that abundant forests in reservoir watersheds translate into lower water-treatment costs. Whitelaw views land-use plans like the Wildlands Proposal as compatible with economic growth and well-being.

Eco-centric at Work

SLOWLY, ACTIVISTS ARE NUDGING THEIR communities and local land managers in an eco-centric direction. Over the past several years a Montana-based group called the Alliance for the Wild Rockies has helped develop and promote protection for 20 million acres of the Northern Rockies that reach into Montana, Wyoming, Idaho, Oregon, and Washington. This preserve system would encompass five ecosystems, requiring a shift in the management of the extensive federal holdings in these states, says Dan Funsch, outreach director for the Alliance.

The group is calling for 16 million acres to be designated federal wilderness,

where logging and mechanized transportation are prohibited. In addition, 1,300 miles of waterways would become part of the nation's Wild and Scenic Rivers system and 4 million acres would be protected as connecting corridors. Because the proposed system crosses state boundaries and involves federal land, the group is seeking to enact a new federal law ensuring its protection. The Northern Rockies Ecosystem Protection Act was introduced in the House of Representatives in July 1993, and by December had 40 co-sponsors.

For the past two years, Funsch and his colleagues have sought feedback through about 50 meetings in towns affected by the proposed legislation. At these meetings, Wildlands proponents try to dispel the notion that this legislation will "lock up" entire forests and put loggers, miners, and others out of work. Instead, they stress the need to protect intact watersheds and forests and to halt the degradation of water and soil.

As might be expected, mining, timber, oil and gas, and ranching interests oppose this action. "They have carried more weight than citizens and non-profit groups," says Funsch. He hopes that the Act, if passed, will lead to new jobs, not just eliminate existing ones. Restoring entire ecosystems means removing excess roads, controlling erosion, and rehabilitating streams — efforts that can boost local economies. This point has helped gain the support of about 500 small businesses throughout the region.

Grassroots efforts aimed at launching the Wildlands plan are also sprouting in the Eastern United States. Scientists are noting severe declines in much of the flora and fauna which comprise the 16,000 square miles of the Southern

¹ *Wild Earth* is published quarterly by the Cenozoic Society Inc., PO Box 455, Richmond, VT 05477. ² "Status and Prospects for Success of the Endangered Species Act: A Look at Recovery Plans," by Timothy H. Tear, J. Michael Scott, Patricia H. Hayward, Brad Griffith, *Science*, Vol. 262, Nov. 1993, p. 976. ³ The 1982 World Parks Congress in Bali, the United Nations Environment Program, the Brundtland Commission, the World Conservation Union, and others; see "A Conservation Plan for the Oregon Coast Range: Some Preliminary Suggestions," by Reed F. Noss, *Natural Areas Journal*, Vol. 13 (3), 1993, p. 286.

RETURN TO WILDERNESS

Oregon Coast Range Proposal



Appalachian Bioregion (including the Blue Ridge Mountains), reports Brownie Newman, a member of a small advocacy group called SouthPAW, based in Asheville, N.C. Several studies indicate, for example, that populations of migrating songbirds are declining in part because intensive clear cutting has fragmented forests, which in turn make the songbirds' nests more susceptible to predators. Black bears, too, are squeezed into less than 10% of their original habitat.

SouthPAW drafted a pilot proposal for core reserves and corridors for both the Blue Ridge Province and the Southern Appalachians. The plans call for prohibiting road-building, commercial logging, and developed recreation on public land. Private land would be acquired or at least designated as conservation areas so that a large enough wilderness network can be established, says Newman. Native species such as elk, beaver, freshwater mussels, and the Eastern cougar would be restored to native

haunts. The group also envisions establishing natural corridors connecting other areas such as the Central Appalachians, the Ohio River Valley, and the Florida Peninsula.

More recently, Reed Noss has worked up a regional plan for Oregon's coastal range. Among other goals, it calls for cessation of logging in old-growth forests, the closing of unnecessary roads, and the restoration of damaged streams. Although Noss expects the plan to bog down in this politically charged region, he plows ahead, optimistic in part because of conservation successes in Florida. There, his input helped the state expand its plans for a comprehensive system of wilderness preserves and corridors. Each year, the state puts up more than \$300 million toward that goal.

"The reason that [Floridians] have accepted [the Wildlands concept]," says Noss, "is they've seen such rapid change that they want to hold on to what they've got."

For Wildlands to realize its potential, Reed Noss believes some large wilderness tracts must become off-limits to people — at least temporarily. Only then can scientists begin reversing decades of degenerative trends. Others argue that locking people out solves nothing. "You may win some battles that way, but in the end you will lose the war," predicts Dale Robertson, an English professor who helped create an interdisciplinary curriculum on nature and culture at the University of California-Davis. He advocates adopting new values which enable humans to remain part of the landscape, but in a less intrusive way.

Even Noss agrees that people must be an integral part of establishing these wild lands. "We're calling for active management of core zones," he says. Hiking, research, and education could continue, as would restoration.

But can one "manage" a wilderness and still have it be wild? That question, only time can answer. ■



DUELING QUOTES AND OTHER FLAWED CONVENTIONS IN ENVIRONMENTAL JOURNALISM

MY INTRODUCTION TO ENVIRONMENTALIST REPORTING OCCURRED FOUR YEARS AGO, SOON AFTER I joined GARBAGE. I was editing an article on "natural" and synthetic cosmetics, which, to my journalist's mind, contained an overwhelming omission. Regulators, retailers, and activists dominated the copy. But not a word came from the manufacturers, not even their research or technical divisions. When I asked the author, who now edits a respected environmentalist quarterly, to get the industry's take on the story, she refused. • "Why bother?" she replied. "I already know what they'd say." • It was, admittedly, the most overt display of environmentalist advocacy in the guise of journalism to cross my desk. But there have been other examples, nearly as egregious. Taking oblique swipes at industry has been not uncommon among the environmental press. Judging strictly from the stories I've killed, reporters' animus toward that faceless thing called "Big Business" reached its zenith in the late '80s and early '90s, when the Man of the Year was Planet Earth and Right Guard aerosol cans and Ronald McDonald's polystyrene clamshells were grabbing headlines. One-sided reporting usually took the form of ferreting out a "polluter," giving a public-relations flak a column inch (or none at all) to plead his case, and then beating him up with criticism from environmentalists and their opinions presented as fact. • It's hardly surprising that industry advocates would take umbrage. More telling is this: Some vocal journalists are, to a certain degree, agreeing with them. In an opinion poll published in April '93 by the Foundation for American Communications, 36% of the more than 500 environmental reporters surveyed confessed that "many journalists have an anti-business bias." • New York Times reporter Keith Schneider, writing in the Society of Environmental Journalists' newsletter *SEJournal*, contends that "over the last two decades environmental groups came to view the press as an ally. We provided a largely uncritical forum for their technical data, and [for] their ideas, theories, and beliefs about the world and how it should be managed."

BY BILL BREEN

ILLUSTRATION BY BARRY BLITT

MEDIA BACKGROUNDER

■ WRITTEN BY AND FOR ENVIRONMENTAL REPORTERS, THE SEJournal NEWSLETTER INCLUDES an "idea exchange" about important environmental issues and developments within the communications profession. In the past few issues, reporters have weighed in on the "advocacy vs. objectivity" debate. SEJournal is published quarterly by the Society of Environmental Journalists, 7904 Germantown Ave., Philadelphia, PA 19118; (215) 247-9710. Membership (including subscription) is \$30/year; \$30/year library rate; \$50/year non-member rate.

■ Environment Writer FOCUSES ON NEWS ABOUT THE ENVIRONMENTAL NEWS MEDIA. "READING RACK," summaries of articles deemed noteworthy, is worthwhile reading. Published monthly by the National Safety Council's Environmental Health Center, 1019 19th St., NW, Suite 401, Washington, DC 20036; (202) 293-2270, ext. 6271. \$29/year; available upon request to accredited environmental journalists.

■ FOR THOSE WHO PREFER A BOOK TO A PERIODICAL, Media and the Environment IS AN EXCELLENT collection of essays chronicling the environmental beat's impressive growth and fundamental problems. The authors offer prescriptions for doing a better job. Media and the Environment, edited by Craig L. LaMay and Everett E. Dennis, The Freedom Forum Media Studies Center. Island Press, 24850 East Lane, Covelo, CA 95428; (800) 828-1302. Softcover, 266 pages, \$17.95 plus \$4.25 shipping and handling; CA and DC residents add sales tax.

In addition to my references above, consider this reading list hand-picked by Bud Ward, co-editor of Environment Writer and a long-time observer of the environmental media:

■ AMONG NATIONAL NEWSPAPERS, The New York Times OP/ED PAGES HAVE GROWN MORE skeptical of environmentalist claims; its "Science Tuesday" section has no equal... The Washington Post has never given the environment a high priority; its coverage of the EPA is particularly lacking, although it is sharper regarding the Interior Dept.... The Los Angeles Times is known for its coverage of air-quality issues (no surprise there); overall, its copy suffers from a problem systemic to the paper — poor editing... On waste issues, the Wall Street Journal is consistently ahead of the pack; environmentalists will find few bosom buddies in its op/ed section... Recognizing that the economy is the bottom line in many environmental issues, the Philadelphia Inquirer has assigned a business writer to the E beat... At the Chicago Tribune, 25-year veteran Casey Bukro is an environmental reporter with that rare advantage in this relatively young field: a sense of history.

■ REGIONAL NEWSPAPERS THAT GO BEYOND LOCAL PROBLEMS, GIVING JOURNALISTS THE SPACE and time for in-depth reporting, include Kentucky's Louisville Courier-Journal (which has produced a number of distinguished alumni); Florida's Orlando Sentinel (it devotes much ink to the environment); the Kansas City Star (traditionally a leader in the field, although its star might be waning); and California's McClatchy newspapers (known for innovative, team reporting) — the Fresno Bee, Modesto Bee, and Sacramento Bee.

■ WHEN IT COMES TO MAGAZINES AND BROADCAST MEDIA: The New Yorker PUT THE ELECTROMAGNETIC FIELD ISSUE ON THE MAP, although it's questionable whether EMF deserves to be there... The New Republic covers the environment from a liberal skeptic's point of view: Gregg Easterbrook's "Everything You Know About the Environment is Wrong" (April 30, 1990) is a seminal piece of reporting... Turner Broadcasting's "Network Earth" is the program to turn to for the environmentalists' side; it does focus on solutions, but suffers from preaching to the converted... Opinion pieces on National Public Radio's environmental-news show "Living on Earth" generally lean green; NPR's "Science Friday" gives listeners a chance to call in to experts on science, technology, and the environment... CBS' "Sunday Morning" with Charles Kuralt takes a progressive look at environmental issues; the show concludes with four uninterrupted minutes of sounds from the wild.

Charges of bias just took a twist, however. In the rush to right supposed wrongs, are journalists beginning to tip the fairness scale in industry's favor? Environmentalists certainly think so. In the wake of articles such as the Times' controversial March '93 series entitled "What Price Cleanup?", which questioned whether investments in more and tougher regulation is money well spent, environmentalists claim that they are victims of a backlash from reporters who favor novelty and conflict over fairness and balance.

A database search shows that "What Price Cleanup?" did indeed spawn a score of reports and editorials in other newspapers, which aped many of the series' conclusions. (Most blatant anti-environmentalist headline: "Eco-Idiocy: Hysterical Environmental Overkill Causes Toxic Economic Pollution," in the Cincinnati Enquirer.) All that really proves, though, is that news gets recycled. The so-called backlash is more likely a case of journalists beginning to reassess their coverage of environmental issues. Two areas get most attention in their debate: the need to expand the sources journalists use for their stories; and how to go beyond objective, "equal time" reporting.

ON ANY GIVEN DAY IN OUR OFFICES, WE might get a press packet from one of the activist Public Interest Research Groups, offering a well-edited, footnoted story detailing some catastrophe or public-health threat, accompanied by color slides and b&w photos. Underneath it in the mailbox, there's a press release from a chemical giant, offering us a geeky photo of some just-promoted middle manager. No question that the activists do a far better job of communicating their side. It should be obvious to a journalist what kind of information resource exists in the research lab of the chemical giant. But to many journalists, it is not obvious — whether because of bias, inexperience, or laziness. Many environmental journalists rely more on the PIRGs of the world. The survey by the Foundation for American Communications found that "environmental activist groups" are the sec-

ond most widely used source by environmental reporters. (For #1, see below.)

Reports from activists often contain valuable information and fragments of truth — but not necessarily the whole truth. Doubters need only recall the Alar debacle, which sprang from the pages of a Natural Resources Defense Council report that had been rejected in peer review, according to Dr. John A. Moore, the acting EPA administrator at the time. Nevertheless, the anti-Alar campaign — abetted by journalists who rolled over for a "story" that featured NRDC mascot Meryl Streep, schoolkids, and "tainted" apples — unjustifiably terrified parents, induced grocers to chuck apples and apple juice in fear of reprisals, and lost apple-growers more than \$200 million.

Hardboiled reporters generally believe that government agencies are more credible than activists and other sources. No surprise, then, that the FACS poll found that government reports comprise the primary source for stories. But even the government is not always trustworthy. Environmental journalists who rely on one source of news — government handouts in the form of press releases — are easily manipulated.

Journalists who want to cut through complacency now turn to non-traditional story sources, such as property owners and town officials, farmers and people in business, scientists and economists, academics and historians. Long-time readers can almost trace the learning curve here at GARBAGE as staffers swept the green veil from their eyes. We realized — by talking to waste managers — that, except in a few densely populated areas, it was nutty to suggest there was a garbage "crisis." Similarly, we came to more realistic assessments of the cloth vs. cotton diaper debate, and even the consensus behind theories of global warming, by looking beyond those sources all-too-ready to give their side.

As our Rolodexes bulged, as we widened our reading to always include original documents, as we developed expertise in certain areas, the writing on some "hot" issues inevitably took on a skeptical tone. That has occurred, too, in publications as diverse as the Wash-

ington Post and Outside magazine. Should this be termed a "backlash"? Hardly. Any good editor would welcome such maturing.

CALLING ON COLLEAGUES TO BACK AWAY from advocacy, veterans including Jim Detjen of the Philadelphia Inquirer and Casey Bukro of the Chicago Tribune have argued that reporters should aspire to objectivity and "play it straight," giving all sides of the debate equal time. If advocacy in journalism means one-sided, unfair reporting, it would be hard to disagree with Detjen. Nevertheless, there is a problem with the "equal time" approach: It doesn't always work.

By their own admission, many reporters are ill-prepared to cover anything more demanding than a chemical spill. The FACS survey found that three out of four reporters say they lack the training and background to cover stories on technical environmental issues. (One telling example: Only 50% of the reporters could even define "chlorofluorocarbons.") Even specialists acknowledge the daunting scope of the environmental beat, which extends to government, economics, and history as well as the natural sciences.

For novices and veterans alike, the hoary journalistic tenet that the "truth" is obtained through a formulaic, even-handed presentation of dueling facts and quotes can provide only a patina of balance and fairness. That approach doesn't measure up when a writer must communicate enormously complex issues.

If a reporter quoted one "expert" insisting the Earth is flat, and another that the Earth is round, would that make a balanced story? The science in environmental reporting can be that bad, charged one critic who said you can't find "balance" with dueling quotes. University of Colorado researcher Kris Wilson says as much in the Winter '94 issue of SEJournal. He urges reporters to present stories which "measure the weight of scientific evidence." The "he said, she disagreed" format, Wilson concludes, obscures readers' understanding of the science.

Editors prefer conflict, where good guys and bad guys predominate — and

are thereby easily balanced. But scientists deal in ambiguities and grey areas.

During the SEJ's national conference last October, the word "uncertainty" permeated discussion. Boyce Rensberger, science writer for the Washington Post, observed that "you can just about take it as a rule that if there is not a statement of the uncertainty, it isn't science." Dianne Dumanoski of the Boston Globe called scientific uncertainty the "central dilemma faced in making environmental policy." And in environmental reporting,

Any journalist who has covered the nuclear waste issue — where the federal government puts all nuclear wastes except spent fuel rods from reactors into a catch-all "low level" category, and anti-nuclear activists maintain (correctly) that such low-level wastes include highly radioactive reactor components, while the generators of the waste maintain (correctly) that reactor components comprise a minuscule portion of the entire waste stream, and the EPA obfuscates matters (for the journalist) because it has not yet finished formulating standards to protect public health in areas surrounding low-level waste sites — will probably agree that many environmental issues boil down to a battle of interpretation of technical data.

It follows that reporters' interpretations frequently shape their stories. That's why many reporters slipped inadvertently into advocacy journalism in the past. It probably fuels the current controversy over "backlash" journalism, too, because interpretive reporting sometimes gets reduced to simplistic dichotomies. Stories that play up scientific uncertainty may "assume that no action should be taken until the threat is overwhelming," observes Dianne Dumanoski. On the other hand, "Stories that highlight a problem and seem tilted in the direction of action frequently ignore or underplay uncertainty."

Dumanoski points out it's unlikely that "scientists will be able to significantly reduce the uncertainties in the foreseeable future." Reporters, she says, "are in for some surprises — and those surprises could go either way." ■

In 1989, the largest American chemical company, DuPont, and the largest U.S. trash hauling conglomerate, Waste Management Inc., announced a far-sighted joint venture called the Plastics Recycling Alliance. They would build new factories in Chicago and Philadelphia using state-of-the-art, automated equipment to sort, clean, grind up, and melt down the two most popular types of plastic bottles and containers — polyethylene terephthalate (PET), the stiffly flexible clear plastic most often seen in giant-size soda bottles; and high density polyethylene (HDPE), a versatile substance found in milk jugs, yogurt containers, hard plastic toys, kitchenware, and office supplies. DuPont chemists would experiment with the resulting resins, developing new types of recycled plastic uses (such as transforming flakes from old ketchup bottles into new auto bumpers). By 1991, said the press releases, the joint venture would operate five factories, handling 200 million pounds a year — proving once and for all that recycling plastic is not only possible, but financially worthwhile.

Two years and about \$22 million later, the venture collapsed.

Time to Dump Plastics Recycling?

By ART KLEINER and JANIS DUTTON illustration by SETH JABEN



Seth Jabin ©

Waste Management Inc.'s (now re-dubbed wmx Technologies Inc.) managers, experienced with glass, paper, and aluminum, found it unexpectedly costly to clean and sort this new material. "It all boils down to economics," Jane Witheridge, a strategic planning vice president at wmx who oversaw the venture, announced to a public gathering in April 1991. "[Plastics recycling]," she told them, "is not economically sustainable."

DuPont's managers, having seen what it took to produce a plastic resin from recycled bottles and containers, decided that these secondary resins would not become part of their core businesses after all. Archie Dunham, then a DuPont executive involved in the deal, gave the excuse that there already was "ample bottle recycling capacity in place"—implicitly, why did they need more? The Alliance was sold to a smaller company, Illinois Tool Works, which now uses the HDPE it processes to make plastic industrial strapping.

The fate of the Plastics Recycling Alliance is hardly unique. Many prominent plastics recycling efforts have lost money, sometimes millions of dollars. This past September, two much-applauded plastic recycling start-ups closed their doors. One, North American Plastics of Albany, New York, had received a grant from a consortium of large plastic manufacturers to develop an approach for recycling polyester film. The other, United Resource Recovery of Findlay, Ohio, had pioneered HDPE recycling. Both claimed they could not sell their products at a price which would let them stay in business. And these are relatively small-scale ventures. The most famous effort to recycle plastics on a larg-

er scale—the "green dot" recycling program, which mandates that recyclables be collected throughout Germany—had to convert \$533 million of its debts into loans recently, due to unexpected processing costs, difficulties selling the goods, and, some say, difficulty collecting what amounts to a tax on German companies. In addition to a market glut in post-consumer recycled plastic, many forms of "virgin" original-use plastic are so cheap today that their recycled counterparts cannot compete.

The fragile economics of plastics recycling has become the subject of increasingly impassioned debates throughout the industry. In part, that's because the "industry" is a large, diverse collective enterprise, with participants who range from the mega plastic-resin manufacturers—chemical companies like DuPont, Dow Chemical, and Union Carbide—to global-scale waste management companies like wmx and Browning-Ferris Industries, to state and local governments, to environmental groups, to small-scale recycling and sorting outfits, and to the processors, brokers, molders, and fabricators (often small, independent industrial firms) who transform recycled resins into new products. At the plastics marketing committee of the National Recycling Coalition's Recycling Advisory Council, probably the most inclusive organization in this arena, members disagree about such basic questions as whether there should even be a national plastics recycling policy—let alone what that policy should entail. Most everyone agrees on one point, though: The national plastics recycling system, as it exists today, is

not workable economically. But they don't agree on why that is.

Dumping Recycled Plastics

"THE REAL SECRET TO UNDERSTANDING WHY plastic recycling is failing," says Marty Forman, "has to do with a fundamental issue: where you buy plastics." Right now, he says, the large makers and sellers of plastic resin (the Dows and DuPonts) don't really want to promote recycled plastic, because it would compete with their primary business—supplying "virgin" plastic resin made directly from petroleum and natural gas. Forman's perspective reflects his role as a small-scale recycling entrepreneur. His Wisconsin-based company manufactures curbside recycling bins made from converted HDPE. His irrepressible optimism for plastics recycling is clear from the name of his company, PolyAnna Plastic Products, which has never yet made a profit. (Forman's other company, a scrap-metal recycling firm founded by his grandfather in the 1920s, is successful.) Forman is not alone in blaming the large resin producers. Many CEOs of recycling and plastic converting companies—the proprietors of businesses involved in plastics recycling—agree. Since they all continue to trade with the large resin manufacturers, however, only a few are willing to speak on the record.

The recyclers' basic argument goes like this: The resin manufacturers felt they had to promote plastics as recyclable, especially after environmentalists began to press for anti-plastics laws in the mid-1980s. But at the same time (the argument goes), the big companies did everything possible to weaken the recycled plastic business. They lobbied against laws which would encourage

DuPont's managers, having seen what it took to produce a plastic resin from recycled bottles and containers, decided that these secondary resins would not become part of their core businesses after all.



Cash crop of the '90s? Hardly.

the use of recycled plastic instead of virgin plastic. They set rigorous standards for purity and cleanliness of incoming materials, making it unnecessarily difficult (according to recyclers) to sell post-consumer plastic. They downplayed some processes which could have abetted recycling — such as a chemical process that removes fire-retardant chemicals from post-consumer polystyrene. And, on occasion, they dropped prices to out-compete recycled plastic.

When asked for evidence of this last charge, small recyclers point to the price of HDPE — SPI code #2, the milk-jug plastic. Late last year, DuPont Canada (a branch of the multinational firm, unrelated to the branch which was involved in the Plastics Recycling Alliance) bought HDPE milk jugs that were collected from Canadian cities such as Toronto, where plastics collection is subsidized by municipal programs. Then they shipped the processed, olive-colored resin by rail to the United States, and sold it for 17 cents a pound. (Tucker Housewares used it in their plastic

kitchen goods.) Meanwhile, DuPont's smaller-scale competitors, who charged 23 cents per pound for equivalent resins, had costs higher than 17 cents per pound. In effect, according to the smaller recycling firms, DuPont was using Canada's subsidized collection programs to dump plastics in the U.S. and undercut the competition.

"We wouldn't want to give the impression that this is our normal selling price," said Al Riddell, the DuPont Canada representative who confirmed the price for us. "Sometimes when we get a higher inventory than we want, we hold 'fire sales.'"

This type of practice may be typical; we heard about, but did not verify, several other similar cases. And in many contexts, it would simply be smart business practice: gaining market share at the expense of a competitor. But it also blocks the growth of a collaborative plastics recycling industry — the kind of industry needed for plastics recycling to succeed over the long term. The small recyclers and plastics converters

we talked to were particularly bitter about underpricing HDPE, because the market for this plastic is so fragile. Along with polyvinyl chloride film and polystyrene, HDPE has been one of the plastics which ordinary citizens most want to see collected, because milk and juice jugs are so visible in the waste stream. (Though hardly sizable — HDPE milk jugs took up just 0.6% of the products discarded in the municipal solid waste stream in 1988, according to the Environmental Protection Agency's most recent data.) But recycled HDPE is especially hard to sell, partly because technical ambiguities make it difficult to guarantee that a load of HDPE is "pure" enough to recycle without damaging the processing equipment, and partly because currently there's a glut of virgin HDPE (thanks to the over-building of HDPE plants during the 1980s).

Representatives of the large companies we talked to, including Dow and DuPont, continue to profess their commitment to recycling as a "principle"

— but when it comes to specific practices, comparatively few seem to involve recycling plastics for use in consumer products. When asked about the future of plastics recycling, DuPont's manager of Environmental Packaging Initiatives, Robert Weis, rattled off a list of DuPont's (admittedly impressive) source-reduction efforts for making thinner films, and intriguing water-soluble plastic pouches (which hold agricultural chemicals and dissolve in the rain). But he cited only one industrial plastic recycling effort: for the polypropylene wrapping that DuPont uses to ship textiles. No mention was made of recycling for consumer products.

In a few cases, plastics industry executives confide a sense of regret that their companies promoted plastics recycling in the first place. Perhaps the most prominent spokesman for this view is Karl Kamena, a former Dow Chemical plastics manager who is carving out a career as a packaging consultant and pundit. "The public has indeed been sold on recycling," he said at a debate sponsored by the National Recycling Coalition in mid-1993. "Perhaps oversold." Kamena argues that companies like Dow should stop promoting recycling entirely, except for the few plastics which have obvious market value. Instead, they should put their resources into overtly convincing the public of the value of incineration.

The Overselling of Recycling

HAS PLASTICS RECYCLING BEEN OVERSOLD? It's true that the virgin-resin manufacturers, along with other plastics and recycling businesses, inadvertently helped build up the over-supply of post-consumer plastic by promoting recy-

cling in the first place. In 1988, the Society for the Plastics Industry (SPI), the pre-eminent plastics trade organization, developed a coding system for the seven most prominent resins, with a number for each type surrounded by the "chasing arrows" triangle which has come to symbolize recycling. Cut into the dies for plastic bottles and containers, the symbols gave the impression that simply by putting these seven plastics out at the curb, they would be collected and recycled. Some people even mistakenly thought that if a package carried the symbol, it was made from recycled plastic. By all accounts, the SPI member companies never intended the recycling code to be a public message, but it caught on nonetheless. By April 1993, nearly 7,000 communities included plastics in their recycling programs — most of them feeling grass-roots pressure to collect all seven of the SPI resins.

The result is a recycling system that seems to ignore the first lesson in basic economics: maintaining the precarious balance between supply and demand. We're increasingly better at supply — collecting plastics, through community buy-back, drop-off, and curbside recycling programs. Hence, recyclers argue that we need to "close the loop" by creating more demand for recycled plastics. As Marty Forman puts it, "It is not enough to lead people to believe that when they put something in a box at the end of their driveway, they should feel like they've accomplished recycling. Until somebody buys the damn product that was made out of what they put at the end of their driveway, recycling doesn't take place." Creating more demand is the only alternative to Kamena's argument that plastics

recycling will never be profitable.

But creating demand is not easy. While the argument that plastics can be recycled is politically persuasive, it is carrying less and less weight in the grocery store. Surveys conducted at Procter & Gamble and elsewhere show that while most citizens expect their plastic to be recycled, they won't go out of their way (or pay a few cents more) to buy a bottle made of recycled plastic.

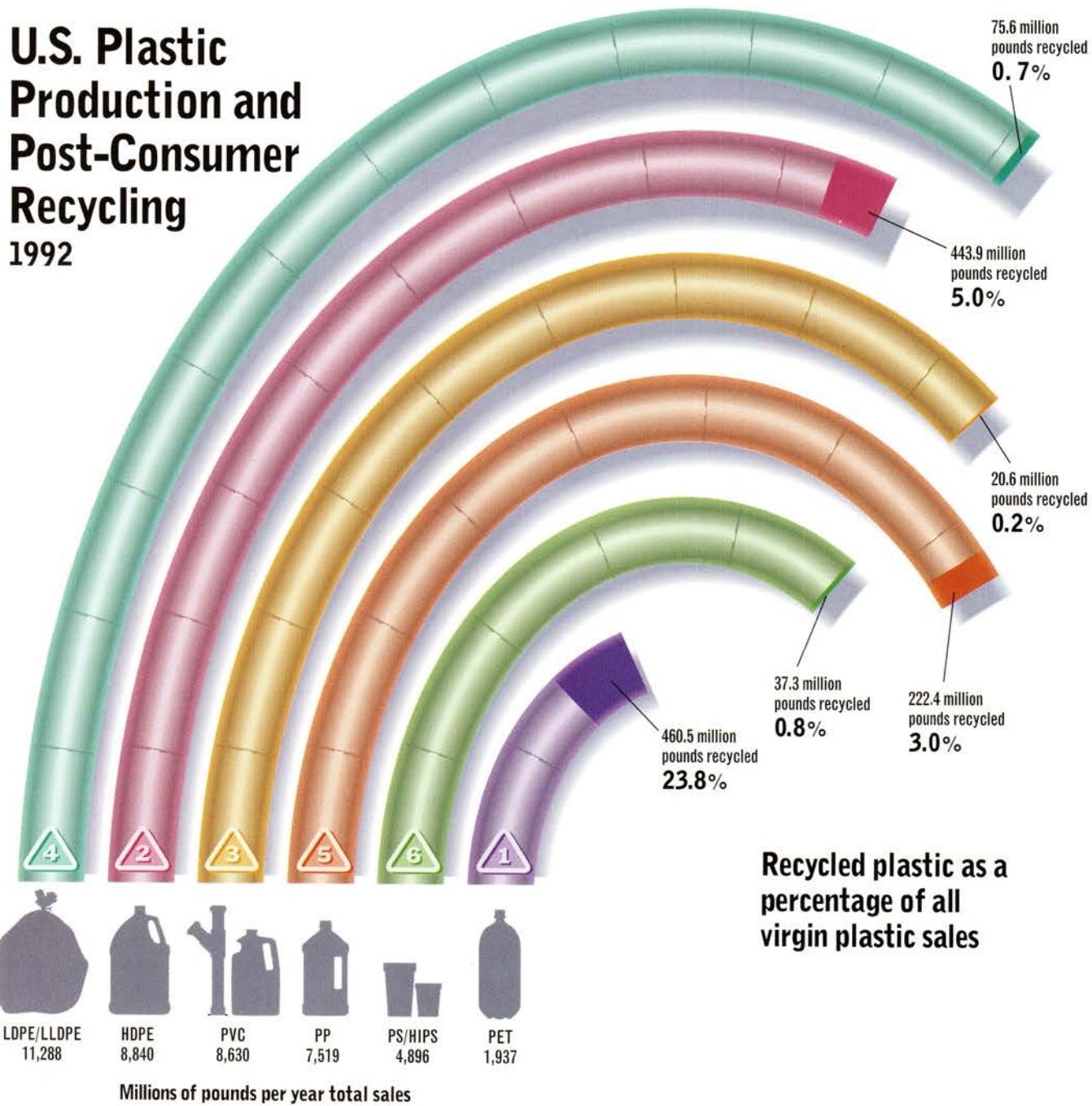
Just about all the players in the recycling industry agree that consumer persuasion is a key strategy. Thus, the American Plastics Council distributes a Recycled Plastic Products Source Book for organizations (and a smaller Consumer's Edition for products sold directly to the general public) to stimulate markets and bring buyers and sellers together. Recycling advocates pressure merchants to carry more items that contain recycled plastic in the product or packaging, and they conduct campaigns to so inform the public. But changing consumer habits takes time.

In a few states, such as Wisconsin, legislators have proposed prohibiting the landfilling of plastics or other recyclables. Environmental advocates, and some small recyclers, want laws to go further; they want to emulate the "rates and dates" legislation that Oregon passed in 1991, which jump-starts the market for recycled products by making manufacturers responsible for using a certain percentage (the rate) of recycled plastics in their products or packaging by a certain year (the date). A bleach container sold in New York State under one proposed law, for instance, would have to achieve a "threshold level" of reusability (you can return it and fill it with more bleach), recyclability (it

Proposed laws suggest that industry or local government should subsidize the costs of recycling, particularly for unprofitable goods like plastics. In California, resin buyers have been forced to pay a government-controlled price.

U.S. Plastic Production and Post-Consumer Recycling

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can be sold and converted into new containers, or at least into new products), source reduction (it would contain less mass than its predecessor, or meet a product-to-package efficiency standard), or recycled material content (it would contain recycled plastic). Going further still, some advocates suggest that America should emulate Italian law, and permit just a few designated types of plastic to be sold — such as dark plastic, into which a variety of colored recycled plastics can blend easily. And finally, a vari-

ety of proposed laws suggest that industry or local government should subsidize the costs of recycling, particularly for unprofitable goods like plastics. In California, buyers of some plastic resins have been forced to pay a government-controlled price.

In varying combinations, recycling firms support most of these measures. The plastics manufacturing industry is fighting every one of them. Even in New York, where most packaging already meets one of the proposed stan-

dards, the legislation is bitterly contested. The American Plastics Council is reportedly spending between \$3 and \$8 million a year lobbying against recycling legislation on free-market grounds — that government shouldn't be in the business of regulating packaging or subsidizing recycling. Some recyclers are particularly angry about this point because federal tax laws already significantly subsidize virgin plastic: Oil and natural gas depletion allowances permit corporations to write off the nat-

Plastics Recyclers Pass the Buck(s)

ALL TOO OFTEN, THE NAME OF THE PLASTICS RECYCLING GAME IS GETTING SOMEONE ELSE to pay for it. Consider, for example, the case of the National Polystyrene Recycling Council. This joint venture of eight large plastics manufacturers was formed in the mid-1980s, during the first wave of protests against polystyrene "clamshell" fast-food containers and soft-drink cups. The group facilitates and promotes polystyrene recycling, which is generally a money loser because the stuff is difficult to sort and expensive to ship. ♦ This past fall, in an effort to broaden polystyrene recycling, NRPC teamed up with United Parcel Service. The "polystyrene UPS program" accepts boxes of used disposable cafeteria trays for recycling, *as long as the supplier of trays pays all costs*. The \$7.50 per box fee, collected by UPS, covers not just shipping, but NRPC's costs for handling and converting the plastic. ♦ NRPC's first potential customers — hospitals, industrial cafeterias, and other large users of polystyrene trays — were lukewarm. But the program hit a bullseye with public schools. Influenced by PTA groups, environmental education programs, and their own students' environmentalist attitudes, 300 schools have signed up in the first six weeks, paying \$3 a child annually. ♦ Fliers touting the benefits of the Polystyrene UPS School Recycling Program continue to circulate, claiming that it costs less than the alternatives. (NRPC spokesman Joe Grandes told GARBAGE that the "alternative" figure is \$7 a child annually for recycled paperboard trays.) Most remarkable is the flier's announcement that "federal funds for school lunch programs may cover the cost of recycling." These federal funds are ordinarily used to subsidize lunches for poor children. ♦ We called the phone number on the flier, identifying ourselves as public school advocates and members of our local parent/teacher group (which we are). We asked about obtaining federal funds to participate in the program; like most public school districts, ours is cash-short. The NRPC representative said they only suggested federal funding as a possibility; he was unsure if it was feasible. "Some people had told us there was a chance, and others said there was no way it could happen." ♦ So we checked further. In Ohio, our home state, federal school-lunch funds might indeed pay for recycling plastic trays — if only because the reporting requirements for school-lunch operating expenses are very lax. Nonetheless, the NRPC representative said the company may discontinue this claim because it is raising eyebrows... and questions. "But these are good questions," he told us, "because somebody will figure out a way to get the federal government

to pay for it." ♦ Using UPS to return used trays for recycling is an ingenious idea, and it solves a problem which haunts not just schools, but all small institutions — where to store the plastics they collect. However, whether federal funding covers it or not, the NRPC school lunch program still amounts to a public subsidy for the plastics industry's polystyrene recycling costs. Schools may be more receptive to sending back their trays than fast-food restaurants or employee cafeterias, but, unfortunately, they're also the institutions which can least afford the program. In the end, if the price of plastic trays can't include the cost of returning and recycling them, then maybe they aren't the bargain they're cracked up to be. Here as everywhere, there's no such thing as a free lunch.

Schools may be more receptive to sending back their trays than fast-food restaurants or employee cafeterias, but, unfortunately, they're also the institutions which can least afford the program.

ural resources they extract and use.

Legislation will continue to be proposed. And the more the battle is fought over legislation, the more divided the plastics recycling infrastructure will become. The most hopeful solutions to the plastics dilemma come from people who propose looking at the entire entity as a single system.

What Chance Cooperation?

IF THE PLASTICS INDUSTRY IS TREATED AS A single system which encompasses recycling as well as production of virgin resins, then its future lies with large companies as well as entrepreneurs and smaller companies that develop new products out of secondary materials. Fortunately, an increasing number of people advocating cooperation among all sides are stepping forward.

Gary Petersen, director of environmental affairs for Recycle America (the pre-eminent recycling branch of WMX) argues that the nation's global economic competitiveness depends in part on integrating recycling into every aspect of the plastics business. "Right now," he says, "we ship our plastic garbage to Asian manufacturers who turn it into telephones and VCRs, creating jobs in the process." Instead, advocates of a vigorous home-grown plastics recycling industry invite us to imagine an extensive recycling infrastructure here in the U.S. Then, they argue, recycled plastics would out-compete virgin material head-to-head. And instead of buying back our own garbage (in the form of new products) at premium prices, we would use that plastic as a prominent raw material — conserving energy, cutting pollution, and creating domestic jobs.

What might that sort of infrastructure look like? One answer has been articulated by Tom Rattray, who manages packaging recycling efforts at Procter & Gamble. Rattray argues that the varied organizations involved in plastics recycling — ranging from industrial giants like WMX, DuPont, and his own company, to entrepreneurial "mom-and-pop" garbage collectors and refabricators — can make plastics recy-

pling economically feasible by working on mutual opportunities for more efficiency. For instance, if different firms came together to redesign the overall sorting process, from the curbside collection to the final melt-down (so the participants don't undo and redo each others' labor), Rattray calculates they could lower the cost of recycled plastic by half a cent per pound. Rattray's other cost-saving proposals — ranging from the redesign of packaging and sorting technologies, to such simple but essential measures as shipping recycled plastic as flakes instead of pellets — also require a great deal of cooperation. While the dissension between recyclers and manufacturers suggests they'll have a tough time working together, they might look at their own polyethylene terephthalate (PET) as a role model.

PET (SPI code #1), the stiff, strong plastic used in soft-drink bottles, is the one unarguable success story in plastics recycling. Noel Malone, manager of plastics recycling for Eastman Chemical (the world's largest producer of PET for packaging) notes that PET's attractiveness to manufacturers depends on the fact that its market demand and recyclability are interrelated. Thanks in part to bottle bills which included PET bottles, the necessary technology, infrastructure, and markets for recycling PET were already in place by the early 1980s. In addition, NAPCOR (the trade group that represents PET producers and manufacturers) worked from the beginning with haulers, material recovery facilities, recyclers, and PET users to fit PET into the existing infrastructure of curbside collection and recycling transportation. The result: Unlike HDPE, reclaimed PET is currently less expensive than

the virgin version.

PET recycling technology is also more advanced than other plastics technologies; in addition to its long-standing demand for fibers used in carpets, winter coats, and sleeping bags, it can also be broken down chemically into its raw materials, which can then be purified and made into new PET bottles. A soft-drink bottle is recycled into another soft-drink bottle; the "loop" is closed.

Large resin manufacturers played little part in the evolution of PET's recyclability. But there is evidence that the chemical giants are more willing to help develop better recycling technologies for other resins. "We get unbelievable support from the chemical industry," says Albin Voegeli, president of Vermont Republic Industries. Like Forman's PolyAnna Plastics, he makes waste bins and other products from recycled plastics. "I have never been refused technical assistance by any manufacturer. I have never had a door closed as a recycler. I can always take my problem to their labs." Of the \$1.2 billion that APC members plan to spend on recycling between 1992 and 1995, 68% of that is targeted for research and development and capital investment in recycling equipment.

"[Resin manufacturers] have had to learn new attitudes from scratch," says Procter & Gamble's Tom Rattray, "but with all due respect, they are learning. And they're beginning to bring some things to the party that haven't shown up in other ways. The first operating color-sorter in the world, for instance, was introduced at Union Carbide." Several companies are participating whole-heartedly in developing chemical conversion technologies, which might break down mixed plas-

tics so they can be recycled into new plastic — without sorting.

The Bottom Line

BUT IS IT REASONABLE TO EXPECT THE LARGE resin companies to change? Many plastics recyclers remain skeptical. "The plastics industry bears most of the responsibility for selling the public and community leaders on plastic recycling in the past," says Theresa Walker, who coordinated technical assistance for a New Hampshire recyclers' organization until recently, and now works at the Environmental Hazards Management Institute in Durham, N.H. "The big companies underestimated the effectiveness and cohesiveness of the grass-roots recycling people who had to take on the rest of the burden. If plastics recycling is going to become economically self-sustaining, then the industry must follow through on its promises."

She concludes: "That means finally coming around to whole-hearted efforts to strengthen the market in partnership with recycling program managers, material haulers, processors, brokers, and the public at large."

This process may mean the industry spends another ten years muddling along, with a gradually changing status quo. Technological changes (such as chemical or heat-based conversion techniques for breaking down plastics into their component elements) may accelerate the changes — or may become a rival to recycling. But even now, the bottom line is clear: If secondary (recycled) resins fail to win significant market share from virgin resins, we'll lose the opportunity to develop a diverse industry that can "close the loop" on recycling consumer plastics.

Advocates of a home-grown plastics recycling industry invite us to imagine an extensive recycling infrastructure in the U.S., using that plastic as a prominent raw material: conserving energy, cutting pollution, and creating jobs.

keeping and staying cool Economically and Efficiently

By Daniel Yoon, Richard Heede, Amory Lovins & Hunter Lovins

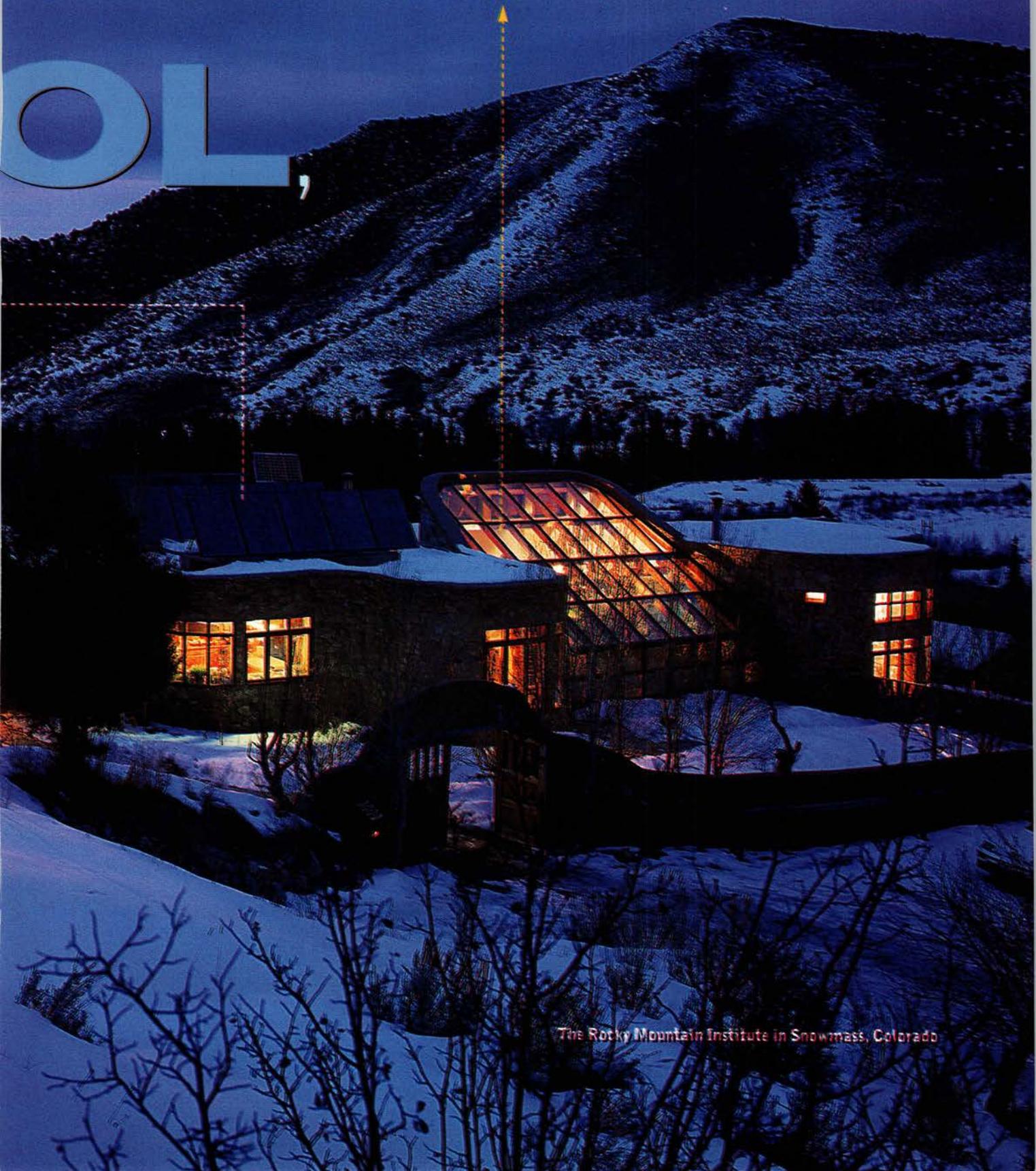
EACH YEAR IN THE U.S. ABOUT \$150 WORTH OF ENERGY PER HOUSEHOLD ESCAPES THROUGH HOLES AND CRACKS IN RESIDENTIAL BUILDINGS, NOT INCLUDING LOSSES DUE TO OTHER INEFFICIENCIES. HEREIN, A REPORT ON THE NATION'S GAINS AND SETBACKS TOWARD BECOMING MORE ENERGY EFFICIENT, FOLLOWED BY LOW-TECH STRATEGIES FOR CONSERVING ENERGY — ONE HOUSE AT A TIME.

buildings are more than just a roof over our heads. They are also consumers of one-third of the energy and more than three-fifths of the electricity produced in the United States. Providing that energy to homes costs over \$110 billion a year, plus environmental and social costs. Each year the typical American home is responsible for 25,000 lbs of carbon dioxide and 113 lbs of sulphur dioxide emissions through direct consumption of electricity and heating fuels.¹

photography by stephen collector

WARM

OLD



The Rocky Mountain Institute in Snowmass, Colorado

Using energy inefficiently also dulls our economic competitiveness. The energy our nation wastes today, through inefficient technologies and outdated practices, is costing over \$300 billion a year, slightly more than the entire military budget of \$10,000 per second. We can only spend a dollar on one thing at a time: if we spend it on oil (\$50 billion a year to pay OPEC for the oil we blow out our tailpipes and chimneys), we can't spend it on education, health care, or investment in new hi-tech industries. Similarly, for many years annual investment in and subsidy of electricity supply have totaled about \$60 billion — equal to total investment in all durable goods manufacturing.

We are, however, doing much better than we were twenty years ago. Since the oil embargo of 1973, homeowners and businesses have cut the nation's energy bills by \$275 billion a year through increased efficiency.² More efficient industrial machinery, automobiles, trucks, and planes; new and retrofitted homes, office buildings, and schools; super-efficient computers, windows, and lights; and numerous other measures and technologies discussed below have held growth in energy consumption to 10.8% since 1973, while the nation's GNP grew by 50.6%.³ This is no more evident than in residential homes, where the energy used per square foot of floorspace has dropped 37% in the past twenty years.

We've only scratched the surface of what's possible. Rocky Mountain Institute estimates a long-term potential to save 75% of electricity at an average cost of 0.6 cents per kWh — several times lower than just the cost of fuel for a coal or nuclear plant. Remarkable advances in lighting, space cooling and heating, motor systems, and appliances have just begun to be tapped. In space heating alone, for example, integrating passive solar heating and storage with superinsulation can cut heating requirements in new buildings by more than 75%.

If efficiency is such a great idea, why aren't we doing more of it? The reasons are many, some of which are very predictable: consumers as well as architects, engineers, and builders lack sufficient information on energy efficient technologies and practices; weak standards for buildings and appliances, low energy prices, and high up-front capital costs for efficiency are also factors. Also, energy efficiency is not financed on the same terms as energy supply. When a utility builds a power plant, it waits twenty years or more to recoup its investment. But consumers who invest in an efficient refrigerator, insulation, or light bulbs usually want to cover their costs in no more than two years. Essentially, there's a ten-fold difference in the discount rates for investments in supply versus efficiency; the result for society is evident.

aT ROCKY MOUNTAIN INSTITUTE WE EXPLORE CREATIVE, free-market opportunities for resource efficiency. Our headquarters building (4,000 square feet) is a great example of resource-efficient design. It's built around a semitropical greenhouse in Old Snowmass, on the western

slope of the Colorado Rockies. The elevation is 7,100 feet, and outdoor temperature can drop to -35°F. But thanks to lots of thermal mass built into the structure to store solar heat, insulation that's twice the amount required by local energy codes, plus super-windows and heat-recovery ventilation, the building is at least 95% passively heated by the sun.⁴ Our backup during cloudy cold-snaps is two wood-fired stoves — there's no conventional heating system. The building also uses 10% of the electricity consumed by an average house, thanks to abundant sunshine and efficient appliances. About 40-50% of the building's electrical load, including computers and photocopiers, is met by approximately 2.8 kW of PV panels on the roof. (The rest is supplied by the local utility.)

It's nice to be saving all that energy and cutting pollution. But it's even nicer to work in such a magical setting. You can blow in and out of a February blizzard and find yourself amidst jasmine, bougainvillea, and orchids. (We're tentatively claiming the altitude record for bananas grown indoors via passive-solar heating — five crops so far.) People seem to feel better in the building, perhaps because of its natural light,⁵ fresh air, and ample humidity. It also makes us feel good to know that the building "produces" about \$9 worth of saved energy and water every day.⁶

Your house probably doesn't look or act much like ours, but it doesn't have to. Whether you're building or fixing up an existing house, broadly similar energy-efficiency opportunities beckon.

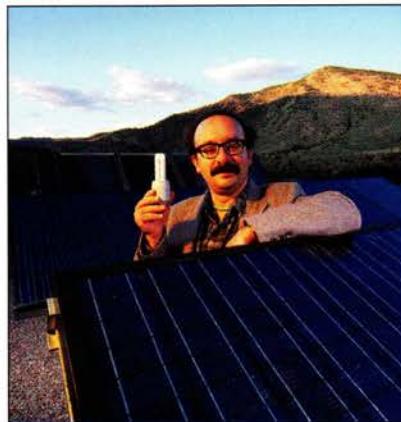
This report sets before you straightforward, cost-effective pointers for keeping warm with less energy. (Most of these tips work equally well to reduce your cooling bills.) While some of the energy saving features at RMI are hi-tech, keep in mind that many of our most effective measures are decidedly low-tech. None of the measures described in this article requires a degree in rocket science, and all make eco-

nomic sense. Once a project pays for itself, it will earn money for you. If you're willing to wait, these projects won't be just a free lunch, but a lunch you're paid to eat.

The General Strategy

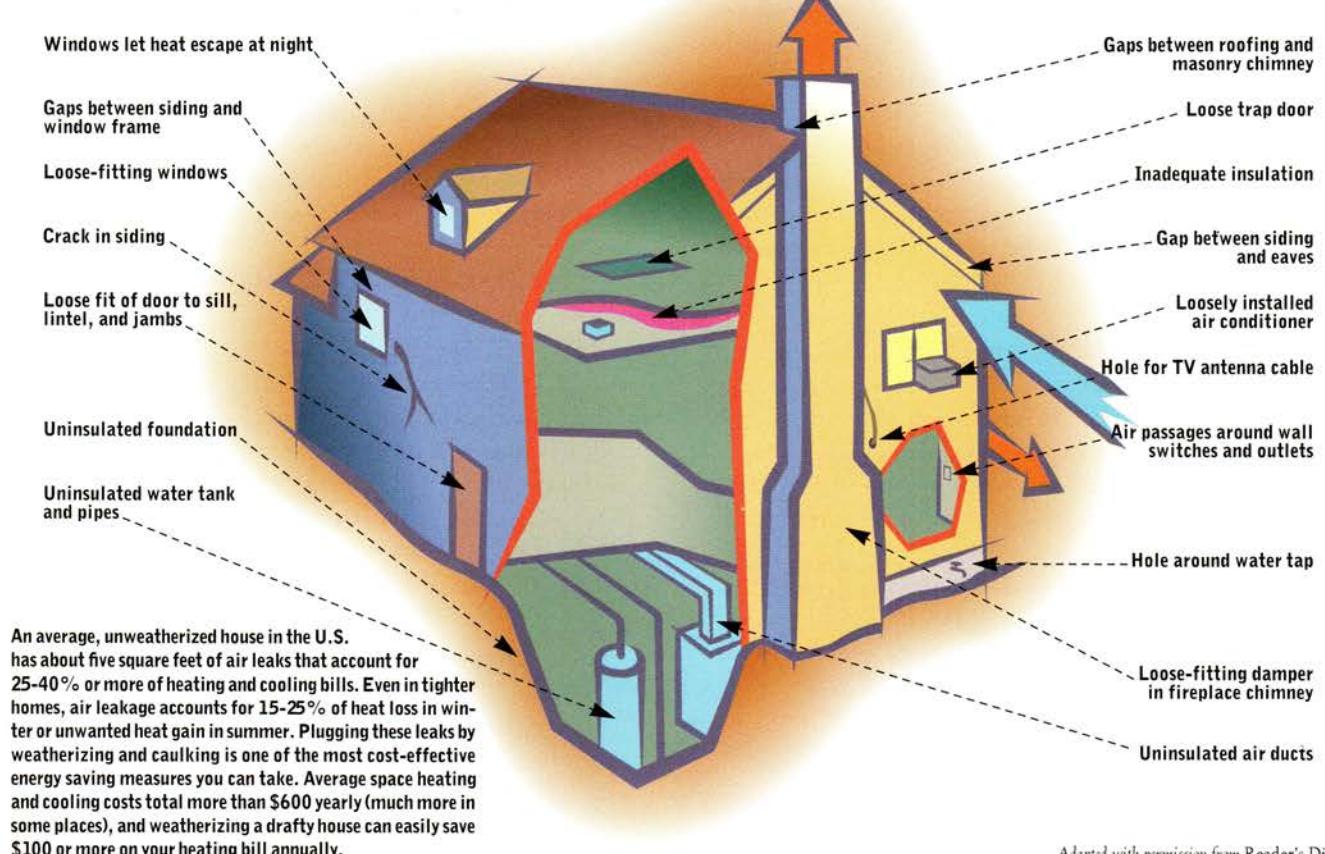
THE OPPORTUNITIES FOR SAVING ENERGY IN HOMES THROUGHOUT the country are often different, but they follow the same general idea: Do the cheapest things first to wring more work from the energy you're already using. If your heating or cooling bills are high, the first solution is *not* to get a more efficient furnace or air conditioner ... but to cut your energy losses through weatherization (reducing air leakage is generally the best bang for your energy-saving bucks), or adding more insulation.

Housing types and climates vary too much for us to recommend the best buys for your home. But the tips below will give you a good idea of how to proceed. And we can't say precisely how much each measure will save — too much depends



Amory Lovins shows off the Rocky Mountain Institute's compact fluorescent light bulbs and photovoltaic panels.

How a House Loses Heat



Adapted with permission from Reader's Digest

on local climate, your home's design, and other factors. Therefore, we recommend strongly that you have a comprehensive energy audit performed on your home before hopping into your overalls. The auditor should list, in order of importance, the steps you should take: insulating, plugging air leaks, tuning up the furnace, upgrading windows, etc. A good audit will usually include a blower-door test, in which a big fan sucks air out of the house to locate air leaks. To find an energy auditor (a.k.a. "house doctor"), call your state energy office, local utility, or look in the Yellow Pages under "Energy Conservation."

Insulation: Your Energy Security Blanket

HALF OR MORE OF AN ORDINARY HOME'S HEAT LOSS IS THROUGH EXTERIOR WALLS, FLOORS, AND ROOFS. An estimated one-fifth of homes have no insulation in the walls, and one-eighth have no insulation in the roof. Many homes that are insulated don't have enough. Fortunately, the insulation of floors and attics of most older homes can be boosted cheaply and easily since these areas are often accessible.

How much insulation to add will depend on your existing insulation, and your climate. An auditor should tell you where you need insulation, roughly how much it will cost, and how much money you're likely to save.

Whether you are adding insulation or building a new house, it may be cost-effective to have an expert buy and install the insulation for you since their volume discounts may offset

their labor costs. When comparing contractors' bids, be sure they are for the same insulating R-value, not just the same number of inches.

R-value and U-value: The R-value is a measure of a material's resistance to heat flow. The higher the R-value, the more insulating the material. A single-pane window has an R-value of slightly less than one. Five and one-half inches of fiberglass insulation is about R-19. Windows are often rated not by R-value but by U-value. The lower the U-value the better. R-2 is the same as U- $\frac{1}{2}$, R-4 is the same as U- $\frac{1}{4}$, R-8 is the same as U- $\frac{1}{8}$, and so on.

WHAT TO USE: Fiberglass and cellulose are the most widely used insulations for home retrofits. They're relatively inexpensive and easy to handle. Since rigid foam insulation boards are more expensive, they're used mostly in special situations such as foundations.

■ **Cellulose insulation**, made of fire-proofed recycled newspaper, is great for retrofitting walls and attics, and has an insulating value of R-3.5 to R-3.8 per inch. Cellulose comes as loose material. It can be mixed with water to form a spray and is often installed by an insulation contractor.

■ **Fiberglass insulation** is also cheap and easy to install. Fiberglass has an insulating value of R-3.2 to R-3.7 per inch, depending on its density. It is available in pre-formed batts or blankets and loose-fill (for blowing into an attic or walls). Be sure to wear gloves and a long-sleeved shirt, and use a car-

tridge respirator. The glass fibers can get into your skin, and they itch fiercely.

■ **Extruded polystyrene**, commonly called "blueboard" or "pinkboard," has good moisture resistance and is used primarily in below-ground and under-slab applications in new construction. It has an insulating value of R-5 per inch.

■ **Polyisocyanurate** is a widely used rigid foam board that boasts a high insulating value of around R-7.5 per inch, and usually comes with a foil radiant barrier on both sides. It costs more than other forms of insulation, but it is useful in certain above-ground applications.

WHERE TO INSULATE: *The attic.* In an unfinished attic, the insulation is right on the attic floor, in between the ceiling joists. In a finished attic, the insulation, if there is any, is above you, between the rafters, which are covered by drywall. If the existing insulation is visible, measure its thickness. Your energy auditor can tell you how much extra insulation should be applied.

There are a few details to handle before you start insulating. Seal any leaks that allow heat to escape from the living areas of the house into the attic (called attic-air bypasses). Also, measure the distance between the ceiling joists so you can buy insulation in the appropriate width. Be careful to keep the insulation away from any heat-generating light fixtures, exhaust flues, and attic ventilators. Consider replacing ordinary recessed fixtures with insulation-contact (ic) rated, recessed cans made for contact with insulation. Finally, if you're adding it to existing insulation, don't buy insulation with a vapor barrier, as that will trap moisture. Attics should be adequately ventilated; your state energy office can help determine if the existing vents are sufficient for your local conditions.

After you've prepared the area, simply lay the insulation on the floor of the attic, right between the ceiling joists. If the joist spaces are already insulated but you want to add more, lay the new insulation across the joists. Make sure there aren't any large voids between the batts of insulation, at the ends, or in tight places. A sloppy job can cut the insulating value in half.

The basement. In cold climates, uninsulated basements can account for as much as 25–30% of a home's total heat loss. Where and how to insulate a basement depends on the type of foundation. For a crawlspace, insulate between the joists of the floor above with at least 5.5-inch (R-19) fiberglass batts. The insulation should be tight against the floor, but don't compress



Daniel Yoon ponders the insulation at the Rocky Mountain Institute — at R-40, it's twice the amount required by local code.

it because that reduces its R-value. While you're down there be sure to insulate the hot water pipes. In cold climates it's worth insulating the rim joist and very likely the floor joists (if they're accessible). Insulating the wall can be worthwhile if you are planning to finish the basement; special insulation systems (such as Dow's "Wallmate") are available for this purpose.

Exterior walls. If your house was built before 1960, you can bet your walls are not insulated. Don't despair — although the walls are closed, a contractor can easily blow in cellulose.

Windows: The Weak Link

WINDOWS ARE THE WEAKEST LINK IN A BUILDING'S INSULATING BARRIER. In winter, they're responsible for 10—25% of a home's heat loss. In warmer climates, ordinary windows admit too much solar infrared radiation; unwanted solar heat gain through windows alone can account for 20–30% of your cooling bill. In any climate, hot or cold, the challenge is twofold: to reduce unwanted heat loss or gain by increasing the window's insulating value; and to optimize the amount of solar gain through shading or careful selection of new, low-e windows or super-windows.

■ In winter, install a clear **plastic barrier** on the inside of your window. After caulking, this is the least expensive, temporary option to cut window heat loss. Kits enable you to do a tidy job using a heat-shrink, clear plastic. Tape the plastic in place and run a hair dryer over it (3 to 6 inches away) to remove wrinkles. (Avoid covering windows which serve as a fire egress!)

■ Also in winter, install tight-fitting **insulating shades**. They incorporate layers of insulating material, a radiant barrier, and a moisture-resistant layer to help prevent

condensation. The whole unit rolls up during the day and can be sealed against the window frame at night, which reduces air flow. You can make these yourself with fabrics such as "Warm Window," available from fabric stores.

LOW-E WINDOWS AND SUPER-WINDOWS

LOW-E WINDOWS AND SUPER-WINDOWS INSULATE UP TO NINE TIMES more than single-pane glass, and they partially block ultraviolet rays. They can cost between 10% and 45% more than a standard double-pane window. But if chosen and installed correctly, they will pay for themselves handsomely in energy savings and enhanced comfort. Generally, high-performance windows also have lower air-infiltration ratings.

Low-emissivity windows (low-e) are the best way to cut

¹ Richard E. Rowberg, *Energy Demand and Carbon Dioxide Production*, Congressional Research Service, Washington, DC, 1993; Energy Information Administration, *Annual Energy Review 1991*, USDOE, pp. 219, 226, 1992; IEA, *Household Energy Consumption and Expenditures 1990*, 1993, p. 65; and RMI calculations.

² Roughly two-thirds of these savings are due to efficiency improvements—better furnaces, appliances, motors, and reducing energy losses in buildings through steps such as those discussed here —

and one-third is due to structural changes in the economy (less steel and more software, for example). Richard Heede, "The NES Strikes a Dry Hole," in *Natural Resources and the Environment*, Volume 6(2), 1991, p. 13; Office of Technology Assessment, *Energy Use in the U.S. Economy*, Washington, DC, 1990, p. 37.³ GNP growth as measured in constant dollars. Energy Information Administration, *Annual Energy Review 1992*, USDOE, 1993, p. 25. ⁴ The building's walls are insulated to R-30, its roof to R-60.

Heat-recovery ventilation transfers 50–70% of the heat into the incoming stream of fresh air.⁵ The building is 95% daylit, with the remaining 5% of lighting needs met by compact fluorescent lights. The overall lighting requirement is less than 0.2 W/ft²; normal offices use ~2 W/ft².⁶ Conventional homes of equivalent size built in our area pay an average of around \$10 per day for energy and water, whereas RMI's utility bills are about \$1.25 per day, hence a saving of nearly \$9 per day.

unwanted heat loss and gain through windows (besides super-windows, described below). The glass bears a special coating which admits a certain amount of heat, but blocks conductive heat transfer. These windows insulate up to four times more than a single pane of glass, resulting in much lower energy bills and greater comfort. Many low-e windows also have argon or krypton gas fills between the two panes of glass, further reducing heat loss in winter or unwanted heat gain in summer.

When shopping for windows, be sure to distinguish between "center-of-glass" R- or U-value and "whole-unit" R- or U-value. The center-of-glass measurements do not include heat loss through the window's frame, which can be significant. Whole-unit R- or U-value is a much more accurate measurement of the entire window's performance. The best low-e windows insulate up to R-4.4 (or U-.23) as measured at the center of the glass. Also, when purchasing low-e windows you have some choice about how much heat from the sun the window admits. It's not always best, even in a cold climate, to get maximum solar gain — this can sometimes lead to overheating in summer.

Super-windows are a step-up from low-e windows, insulating up to R-9 (center of glass). That's three times better than triple pane. They work in the same way as low-e windows,

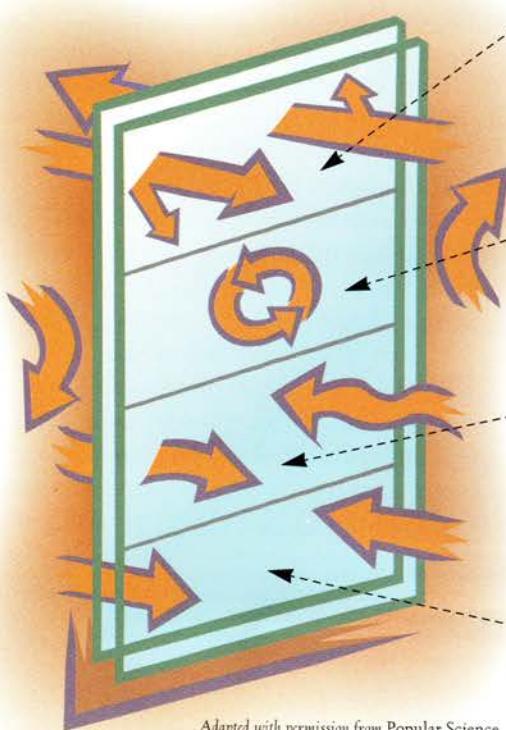
except the special low-e coating is applied not to the glass itself but to thin, plastic HeatMirror™ films. These films are suspended between the two panes of glass. Argon gas fills are common on super-windows, as are well-insulated frames. Nonetheless, be sure to check the whole-unit R- or U-value before you make any purchases.

As with low-e windows, you have a say in how much solar heat your super-windows let inside. Ask your retailer about the full range of HeatMirror films, from HeatMirror 22 (which blocks a lot of heat from the sun) to Heat Mirror 88 (which admits a lot of heat from the sun). Heat Mirror windows are the premier means to reduce cooling loads for large, commercial office buildings. Super-windows are usually *not* cost-effective for a retrofit, but they should be an integral part of super-efficient new homes. ■



Richard Heede's room with a view, courtesy of super-windows — three times more efficient than triple pane.

How Energy Flows Through Windows



Adapted with permission from Popular Science

RADIATION

Energy moves through windows in both directions: Into the house and out. Radiative energy transfer occurs in several ways. Sunlight is transmitted directly through most windows. Radiant heat is absorbed by glass and then radiated.

CONVECTION

Air rises against warmer glass surface and falls along the cooler surface in the space between the panes. These convection currents of air can transfer heat from one pane to the other.

CONDUCTION

Heat conducts from the warmer to the cooler side of a window as each molecule excites its neighbor, passing the energy along. Conduction occurs through the glass, the window frames, and even the air or inert-gas fill between the glass layers.

INFILTRATION

The tighter the window and the better the weather stripping, the lower the air leakage that occurs around and through windows.

For More Help

THIS REPORT IS INTENDED TO GET YOU STARTED. FOR THE FULL story, get a copy of *The Energy-Efficient Home* by Rocky Mountain Institute, either at your bookstore (\$9.95) or by calling RMI directly; (303) 927-3851 (add \$2.00 for shipping and handling). If you're building a new home and want to take advantage of cost-effective, state-of-the-art efficiency opportunities, call RMI for a copy of *The Efficient House Sourcebook* (\$15.00 ppd.).

Listed below are three other sources of particularly useful information:

Consumer Guide to Home Energy Savings by Alex Wilson and John Morrill, American Council for an Energy-Efficient Economy, Publications Dept., 2140 Shattuck Avenue, Suite 202, Berkeley, CA 94704; (510) 549-9914. Softcover, \$8.95 ppd. Details numerous energy-efficient retrofits for existing homes; includes an extensive resource list covering periodical, state and federal energy offices, and regional hotlines.

Conservation and Renewable Energy Inquiry and Referral Service (CAREIRS), PO Box 3048, Merrifield, VA 22116; (800) 523-2929. Provides basic consumer information on the full range of renewable energy technologies and household energy-efficiency opportunities.

National Appropriate Technology Assistance Service (NATAS), U.S. Department of Energy, PO Box 2525, Butte, MT 59702; (800) 428-2525, in MT, (800) 428-1718. NATAS can answer relatively technical questions regarding renewable energy and energy efficiency.



Communicating Science

ONE OF THE PARADOXES OF MODERN society is that technology allows many people to live in unprecedented comfort despite ignorance of the physical, chemical, and biological processes that support their lifestyles. Modern citizens thus have limited perspective regarding the impacts of technology on human health, and may be

too easily swayed by arguments founded on romantic misconceptions of pre-industrial conditions. (I recommend Martin Lewis's excellent treatment of this topic¹.)

In my annual introduction to a course on hazardous-waste management, I always include the following quotation from physicist and science historian Gerald Holton:

"...persons living in this modern world who do not know the basic facts that determine their very existence, functioning, and surrounding are living in a dream world. Such persons are, in a very real sense, not sane."

"If [the link between science and policy] is not understood, if the technical implications for good and ill are not made clear, democracy is at risk because the leadership can be caught up in fantasies — whether technocratic or Luddite — and the citizenry cannot participate in the basic decisions that have technical components."

The text is from Holton's tribute² to Danish physicist and Nobel laureate Niels Bohr. Holton asserts that integrity in science requires not just avoiding dishonor, but also positive action including education of the public.

IN TRASHING THE PLANET,³ THE LATE DIXY LEE RAY RAISED THE question: "Who speaks for science?". The editors of GARBAGE were sufficiently impressed by this query to adopt it as the focus for a regular feature. Dr. Ray's complaint, essentially, has been that while scientists occupy themselves with science, public debate is dominated by unqualified alarmists whose false claims are fostering grossly inappropriate policies. In a second book⁴, Dr. Ray re-

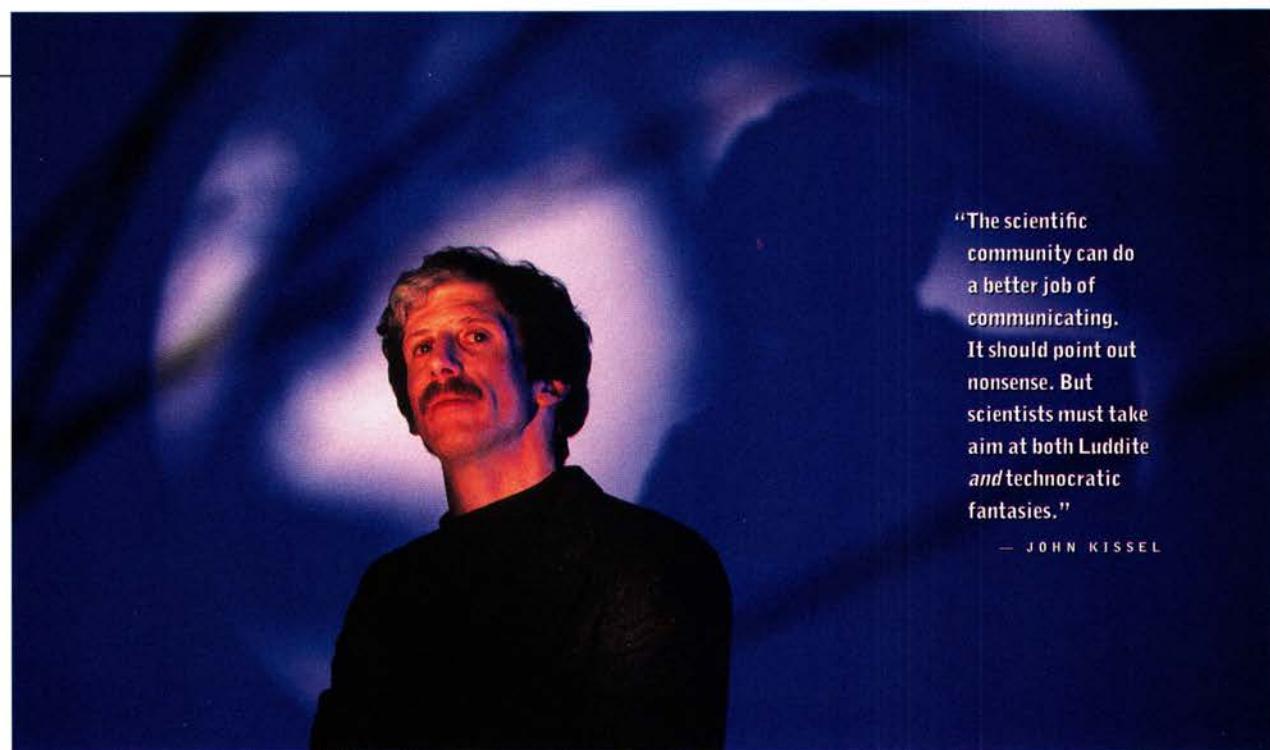
iterated her lament that scientists and their professional organizations fail to aggressively dispute dubious claims, and echoed Holton's view that scientists have an obligation to the public. The two books are her attempt to fill the breach.

However, Dr. Ray's ideological bias got in the way of instruction. An ardent proponent of the status quo, she perceived a significant threat from the green left and its allies in the news media. To defend current technological society, she sought to establish authority by wrapping herself in the mantle of science. (Attempts to appropriate the credibility of science have been with us a long time; hence, Christian Science, "creation science," and Scientology.) While paying lip service to the scientific method, however, Dr. Ray failed to practice what she preached. It is imperative to beware the flaws in her books, which continue to be widely cited.

In dismissing the arguments of environmental activists, Dr. Ray decried biased or selective presentation of information and the use of "experts" who lack stature in the field in which they are testifying. She praised science's objectivity and the checks provided by the peer-review process. Yet, curiously, the overwhelming fraction of references cited by Dr. Ray are either op-ed pieces published in vehicles with well-established right-of-center orientation (the *American Spectator*, *National Review*, *Wall Street Journal*, and *Washington Times*), or position papers released by interest groups, or other works that fall outside the purview of peer review. Dr. Ray's selection of experts was also haphazard. For example, her arguments on ozone depletion depend heavily on the work of Rogelio Maduro, whose credentials consist of a B.S. degree in geology and whose "science" is published by his employer, a firm linked to Lyndon LaRouche's political movement.

Dr. Ray apparently felt no need to verify any of the information she extracted from secondary sources. Although the length of this column precludes discussion of all such evidence, I can, for instance, refer readers to a nine-page segment⁵ of *Environmental Overkill* wherein are misrepresented

¹Lewis, Martin W.: *Green Delusions: An Environmentalist Critique of Radical Environmentalism*, Duke Univ. Press, Durham, NC, 1992. ²Holton, Gerald: "Niels Bohr and the Integrity of Science," *American Scientist*, 74:237-243, 1986. ³Ray, Dixy Lee with L.R. Guzzo: *Trashing the Planet*; Regnery Gateway, Washington, DC, 1990. ⁴Ray, Dixy Lee with L.R. Guzzo: *Environmental Overkill*; Regnery Gateway, Washington, DC, 1993. ⁵_____. op. cit., pp. 139-147.



"The scientific community can do a better job of communicating. It should point out nonsense. But scientists must take aim at both Luddite and technocratic fantasies."

— JOHN KISSEL

PHOTOGRAPH BY Rex Rystedt

the results of studies of health effects at Love Canal, inter-species differences in dioxin toxicity, the conclusions of a NIOSH study of health effects in workers exposed to dioxin, the reasoning behind removal of PCBs from production, and the reason chloroform exposure during hot showers is of concern.

Yes, some of her targets are deserving of criticism—but that is an unpersuasive defense. Left-wing nonsense does not validate right-wing nonsense. Each side must take its share of the blame in reducing American political debate to simplistic dichotomies.

SPEAKING FOR SCIENCE, CAN THE LEVEL OF DEBATE BE RAISED? Scientists avoid the public arena for many reasons: a professional reward structure that provides little (or negative) incentive for diverting from formal science; the frustration of dealing with ideologues; the difficulty of communicating complex arguments in an era when sound bites rule; and, not least, the inability of science to resolve questions of social values (the crux of many environmental disputes).

Even if the scientific evidence is evaluated fairly, whatever social policies are adopted will necessarily reflect value judgements. Good scientists attempt (with varying degrees of success) to separate that which is supported by evidence from that which they believe based on personal values. In contrast, activists and ideologues (even those with scientific credentials) do not hesitate to impose their

values on society, and to claim that science is on their side.

The scientific community can do a better job of communicating. It should answer Dr. Ray's call to point out nonsense. But, mindful of Holton's admonition, scientists must take aim at both Luddite and technocratic fantasies. Communication, however, involves both transmitter and receiver. Non-scientists can and must cultivate critical thinking skills to serve them when they are faced with claims of scientific authority.

Modern technology has produced a net reduction in human risk by replacing large risks with smaller ones. Some environmentalists have dangerously skewed views on the relative costs and benefits of technology. But there are costs and consequences to be debated. The fact that impacts of human activities are detectable on a global scale is sufficient grounds for examining the potential consequences. Some compromise between non-human welfare and human activity must also be struck. Complex, value-laden questions must be addressed. Arguments that summarily dismiss such concerns are not "scientific," they are flippant.

Dr. Kissel is an assistant professor in the Department of Environmental Health at the Univ. of Washington's School of Public Health and Community Medicine (Seattle). He holds a Ph.D. in civil (environmental) engineering from Stanford Univ. and participates in the peer-review process as both author and reviewer.



"Porcupines" Help Rescue Trout

WHY SHOULD PEOPLE WHO don't fish care about restoring an ailing trout stream? Trout are an indicator of a healthy aquatic ecosystem, for they require unpolluted, cold water with plenty of oxygen. They play a role like that of canaries in a coal mine. When trout are thriving, we know that the water quality is pretty good. If a stream is clean enough to support trout, it will require less chlorination and other treatments for those living downstream who drink the water.

West Valley Creek, the site of a 13-year old, award-winning restoration project carried out by the Valley Forge Chapter of Trout Unlimited, flows west from headwaters near Exton, in eastern Pennsylvania, eventually entering the Brandywine River, a tributary of Delaware Bay. It's a gem of a stream which meanders past farms and woodlots which are being converted into housing tracts and light-industrial parks in Chester County — one of the fastest growing counties in the U.S.

West Valley Creek has its share of troubles, which are common to urban streams throughout the country. The worst problem is sedimentation. Rain falling on pavement and roofs can no longer soak into the ground. Heavy rains result in floods which deposit tons of soil eroded from the watershed, choking pools and riffles (shallow rapids). Since much water is diverted into storm drains, our urban stream is also subject to low-flows during times of drought.

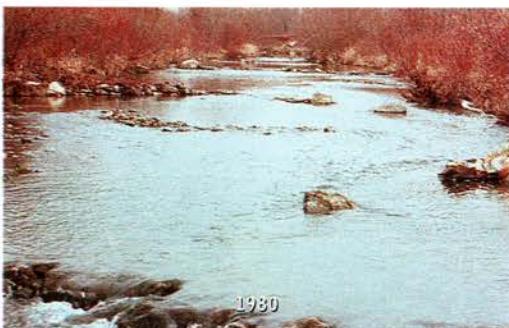
Pollution is another prob-

lem. West Valley Creek was slicked by an oil spill from a broken pipeline. Gasoline from rusted service-station tanks oozed into a pristine spring which feeds the stream. Salt de-icers and other contaminants from roads and parking lots, and herbicides and pesticides from lawns soak into the stream during heavy downpours.

In 1976, a few people who love to fish for trout formed the Valley Forge Chapter of Trout Unlimited to preserve, conserve, and restore the waterways and watersheds of Chester County. One section of West Valley Creek had been dredged and relocated to allow the construction of a limestone quarry. Dredging removes insect-producing riffles and the natural bends, or "meanders," which provide essential trout habitat. The result: Much of the creek's aquatic life was destroyed. With guidance and approval of the Pennsylvania Fish Commission, we set to work to heal the stream. To do so, we had to learn the characteristics of healthy streams and the techniques of restoration.

We used devices suggested in stream restoration handbooks (such as *Guidelines for Stream Management in Wisconsin*, Wisconsin Department of Natural Resources, 1967). Joe Armstrong, a long-time Chapter leader, invented

a "Porcupine" structure which has proved particularly helpful in making constructive use of the silt and sand which is swept along by the current. (See illustration, opposite.) Straight sections of tree limbs, three to four feet long, are sharpened on one end. These are driven with a sledge hammer into the stream bottom, at a place where a new stream bank is beginning to form. Next, branches are woven into the stakes. The goal is to restore the creek's "meander," and begin to make the



1980



1989

Dredging for a limestone quarry destroyed much of the stream's aquatic life (top). Years later, our submerged Porcupines created riffles and returned the stream's natural curves.

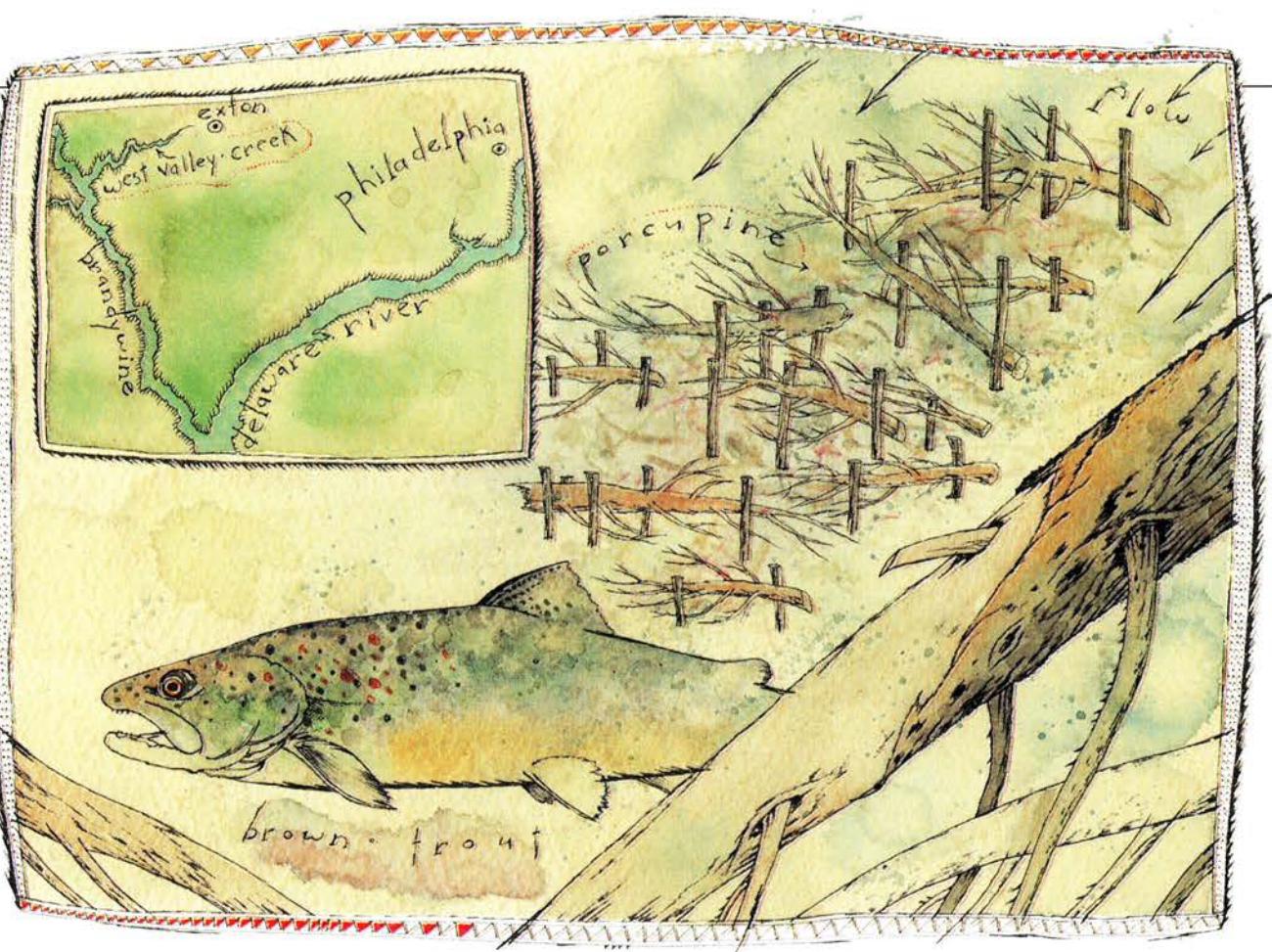


ILLUSTRATION BY Mike Reagan

A newly constructed Porcupine in West Valley Creek: Trees and limbs trap sediment from eroding stream banks, eventually building a mud bar that will be invaded by vegetation — and trout.

sediment in the water work for the creek's health, rather than against it. We figured that silt would pile up on the Porcupine, eventually forming a new stream bank which narrows the creek and creates riffles.

Several years after construction, our Porcupines sported coats of reed canary grass and bush willows. They looked fairly permanent, but what one flood deposited the next might wash away. Most of the plants remained just a few inches above water level at the highest points, so Joe created another device which we call the "Christmas Tree Deflector." On top of a Porcupine, a line of Christmas trees was staked into the ground and tied down. Flood waters now flow through a narrow channel, digging a holding pool for trout and depositing sediment on and behind the deflector. This technique has produced new stream banks which are one-to-two feet above the low-water flow.

WHY HAS RESTORATION BEEN IMPORTANT? IT GOT US INTO THE water. By doing the little things we could do to help the stream heal, we identified with the stream's well-being. After even a short work day, we could see that our efforts were making a difference. This drove us to set more ambitious goals, such as restoring the riparian zone (the area adjacent to the stream banks) and protecting and revegetating the entire watershed. As our objectives became clearer, we could communicate them better to developers, township supervisors, and county planners.

Above all, we learned to link biology and engineering techniques for healing purposes. As a result, we've done something we previously thought impossible: Despite past degradation of West Valley Creek's watershed, we've re-established stream-bred trout.

Mr. Owens is the author of *Living Waters: How to Save Your Local Stream* (Rutgers University Press, 1993). He lives in Chester County, Pa., where he is the director of ecology and racial justice for National Ministries, American Baptist Churches.



Are there any dioxins next to skin when babies wear disposable diapers? What about bleached white toilet paper and tampons?

HELEN MASTERSON, SAN FRANCISCO

DIOXINS ARE A BY-PRODUCT OF THE CHLORINATED BLEACHING process, which whitens and brightens the pulp used to make paper products. The locus of concern and debate surrounding dioxins, 2,3,7,8-TCDD in particular, is primarily the effluent from the paper mill, not the bleached-paper products themselves. There are indeed trace amounts of dioxins present in bleached paper products, but at levels so small they do not constitute a health risk.

In the 1980s the EPA, in conjunction with the U.S. Consumer Products Safety Commission and the U.S. Food and Drug Administration, evaluated the risk posed by dioxin in the pulp used for a range of consumer products, including disposable diapers and tampons. Dioxin levels were barely detectable in some products; in others, scientists could not detect dioxins at the lowest measurable levels. That is, researchers found that the pulp had dioxin levels of one part per trillion or below — a cancer risk they evaluated to be below one in a million.

While the EPA continues to reassess the risks posed by dioxin, commercial and regulatory pressures have caused the paper industry to reduce its use of elemental chlorine in bleaching. (See "An Inside Look At Paper Recycling," Sept/Oct '93.) For example, according to Dwain Winters, director of the EPA's Dioxin Policy Project, when the original risk assessment found that some food service products like milk cartons had slightly higher dioxin levels than other consumer products, the manufacturers quickly moved to reduce those levels so they wouldn't lose market share to plastic milk containers.

The bottom line? Dioxin levels in consumer products needn't be part of your figuring when you decide which products to purchase.



Can the color of your home's roof significantly affect cooling costs?

ELI WHITE, CAMBRIDGE, MASS.

WHITE ROOFING WILL KEEP YOUR HOME COOLER THAN BLACK roofing for the same reasons that people wear white clothes in summer: black absorbs light and white reflects it. How much difference the roofing's color will make, however, depends on conditions in the building and the type of roofing material.

Standard black asphalt shingles absorb 95% of the sunlight energy that hits them. Standard white asphalt shingles absorb just 70-75%, and reflect 25-30%. While the 20% difference between asphalt shingles isn't insignificant, the white/black spread is much greater with other roofing materials, such as tile roofing and EPDM (Ethylene-Propylene-Diene-Monomer), a watertight synthetic usually used on flat, commercial building rooftops. (You roll it out like the rain tarp on a baseball field.) White tile reflects 70% of the sunlight energy that hits it; white EPDM reflects as much as 80%. White metal-tile roofing is also highly reflecting, as is elastomeric coating, a rubberized paint used on commercial buildings.

The effect roofing color of any material will have on cooling costs depends on several factors. A home with good attic insulation (R-20 or better), or one that's well shaded, will not benefit as much from white reflective roofing as a poorly insulated building. However, there are many homes,



particularly in the South, which lack insulation and are topped with black tar-paper roofing exposed to direct sunlight. By switching to white tile, these homes can attain as much as 40% reductions in cooling costs, according to a study by the Florida Solar Energy Center, a state funded group that conducts research on alternative energy.

There are also aesthetic and cost questions to think about. Metal tiles and even standard white tiles are very bright and may not go with your home's style or color. Elastomeric coatings are expensive and will void any warranty on your roof. Nevertheless, many homeowners use more energy (and spend more money) to cool their homes than they would if they simply re-did the roof in white. For more information, contact Danny Parker, Building Design Assistance, Florida Solar Energy Center, 300 State Road 401, Cape Canaveral, FL 32920; (407) 783-0300.

I've always assumed that washing dishes by hand is better for the environment than using an automatic dishwasher. Am I right?

ALEXANDRA McCORMACK, STONEHAM, MASS.

ONE WOULD THINK SO. BUT DISHWASHERS OFTEN SAVE ENERGY and water compared to hand-washing.

Depending on the brand, dishwashers typically consume from 7.5 to 12 gallons of water per wash on their "normal" cycles. Some brands use as little as 5.5 gallons per cycle. While the figure varies from household to household, many

people use upwards of 15 gallons of water to handwash a day's worth of dishes. According to the American Council for an Energy Efficient Economy, a recent Ohio State University study found that dishwashers consume about 37% less water than washing by hand. And less water means using less energy: Sixty percent (sometimes more) of the energy utilized by dishwashers goes to heating the water.

In addition, the machines themselves are becoming more energy-efficient. On May 14, a new federal standard comes into effect requiring increased energy efficiency from all new dishwashers. Some brands already meet the new standard. You can check a dishwasher's energy efficiency by referring to the "EnergyGuide" label displayed on dishwashers. The ratings which appear on the labels are based on the energy expended by running the machine 322 times a year on the "normal" setting. (Using a different setting could result in energy use which varies significantly from the label's rating.)

For additional energy savings, follow these tips from the ACEEE: #1. If your dishwasher has a booster heater (and many newer models do), turn the setting on your home's water heater down to 120°. The booster will heat the dish water an extra 20° (which should be plenty hot), and you'll



save on water heating costs. (See "Ask Garbage" Sept/Oct '93.) #2. Most dishwashers use hot air to dry the dishes. Using the no-heat/air-dry feature will save a little energy. If your machine doesn't have this feature, turn the machine off after the final rinse, open the door, and let the dishes air dry. (This could, however, increase spotting.) #3. Don't pre-wash dishes before putting them in the dishwasher. Most machines can handle even heavily soiled plates. (Consumer Reports agrees. See their October '93 issue for performance ratings.) #4. Run only full loads.

[“Ozone,” continued from p. 7] Eberling from Australia, this attenuation of cfcs in the very lowest part of the stratosphere is likely due to the physical behavior of gases (Boltzman Equations) rather than to destruction by ultraviolet radiation. Dr. Robert W. Pease, Prof. (Emeritus) of Climatology at the University of California, calculates that there are at least 43 million molecules of ozone created for every one cfcc molecule broken down. These are among the research results that Dr. Rowland does not accept.

Natural sources of chlorine. I have two comments. First, the figure of 289 billion kilograms (equal to 289 million tons) of hydrochloric acid from the 1976 eruption of Alaska's Mount St. Augustine comes from the monitoring and analytical studies of volcanic emissions carried out at the University of Alaska's Geophysical Institute. The Mount St. Augustine number was published in the *Geophysical Institute Quarterly* (Vol. 4, No. 9, July 1986) by Dr. John Davies, who is also Alaska's Chief Seismologist. This figure is also included in the 1989 edition of Van Nostrand's *Scientific Encyclopedia*. Alas for my “terrific blunder,” I did not make the calculation, nor did I claim to. My error was failure to quote my source. Had I done so, I would have saved myself a lot of grief! Incidentally, I have a lot of confidence in Dr. Davies' research.

Second, the Polish geophysicist Zbigniew Jaworowski recently published the results he obtained from studies of various elements reaching the stratosphere following the Chernobyl disaster. Using the radioisotope Cesium as a tracer he established that the molecules of several elements, including chlorine, do indeed reach the stratosphere. His paper is entitled “Fallout Studies Show that Marine Chlorine

Reaches Stratosphere.” *Journ. 21st Century Science and Technology* (Spring 1993, pp. 6-7).

Certainly, it is correct that it hardly ever rains in Antarctica. Also, the stratosphere above the South Pole dips very close to the earth's surface; it is only 5,000 meters above sea level. Mount Erebus is located on a plateau with its summit at 4,000 meters, so that molecules need rise only 1,000 meters.

Let me once more commend you on a thoughtful article, properly skeptical of claims unsupported by evidence. Of course, even where evi-



dence is available, it is subject to interpretation—so the debate will go on! The tragedy is that significant public funds are being committed more on political grounds and computer projections than on the basis of supportable science.

— DIXY LEE RAY
Fox Island, Wash.

Dixy Lee Ray was a former governor of the state of Washington and controversial head of the Atomic Energy Commission. She died in January at the age of 79.

THE ARTICLE WAS PERHAPS THE BEST overall writing I have seen on the subject. I have read almost all of your references, and my opinion is that something is fishy here. A suspicious person might conceive the following scenario. First, find (or, if necessary, cook up) a theory that forecasts some

impending disaster. Second, publicize it, alert the numerous environmental concern groups, and mobilize them to call for action. [Now] take huge precautions, sparing no expense, to overcome the (theoretical) problem. Then, if nothing happens, you can claim credit for averting the disaster!

In the meantime, certain chemical companies become wealthy in spite of the fact that one of their prime patents ran out, and certain government agencies get huge budget increases in spite of the pressure to reduce funding! Furthermore, the refrigeration industry can build and sell new systems to re-

place all the old ones, even if they aren't worn out. Best of all, the new systems will not last nearly as long as the old ones. Boy! If I were a politician, I would immediately contact the chemical and refrigeration companies for election funding, wouldn't you?

The “global warming” disaster already has many similar elements.

Worse, both will seem to require reductions in the application of technology, resulting in lower opportunity for the poorer nations to become wealthy. Sound familiar?

— JAMES C. BIGGERS
McLean, Virginia

THE CONVENTIONAL WISDOM IN THE refrigeration industry is that the phaseout of cfcs (and soon to be hcfc's as well) due to ozone depletion fears is a hoax. I could not agree more that the costs of this phaseout are astronomical. I have formed a company that trains service mechanics and contractors under the certification requirement of Section 608, Title VI of the Clean Air Act Amendments of 1990. That requirement will cost the industry approximately \$50,000,000 by the end of 1994. The cost of equipment to recover and/or recycle cfccs,

HFCs and HCFCs (by November 1995) will cost another \$250,000,000. This does not include paperwork, additional labor, and so on. Of course, the refrigeration and air conditioning industry will not absorb these costs, they will be passed on.

Still, I am very uncomfortable dismissing the [argument for a phaseout] as there is tremendous venting of refrigerant, law or no law. It's a terrible dilemma.

I am writing a book on the effects of this phaseout and ban on the general public. This unfortunate group has no idea how their lives will change in the next few years.

— VICTORIA M. KAMM
Director, Thermal Engineering Co.
Toledo, Ohio

THERE ACTUALLY IS SOME RESEARCH going on re: measuring UV-B at surface levels [Canadian Study]. However, it appears such measurements were carried out over a short period of time in a localized area near a major metropolitan source of pollutants. Without your article of September 1993, I would have concluded that the sky is falling. However, it occurs to me that the variation noted by Environment Canada is within normal limits.

I agree with your basic premise: that in the interpretation and application of scientific research, our society needs to be more rigorous than emotional. I know that hasty conclusions will result in a waste of time, money, and the opportunity to repair clear and unambiguous damage to the environment. Please keep up your insightful analysis and don't hesitate to apply it to other environmental issues.

— BOB CARTLIDGE
Leamington, Ontario

To John B. Chamberlin Jr.: Thank you for your letter. — Patricia

[*"Is Garbage an Environmental Problem?" continued from p. 9*] and inform individual readers. From that perspective, thank you for your careful reading and your thoughtful response.

YOUR POSITION WILL BE SUPPORTED BY the professional producers and disposers who have always questioned the perspectives of "the crisis," but were unable to speak out because of the politically correct pummeling they would have received.

The October conference in London on solid waste/packaging, sponsored by the Financial Times, featured the environmental ministers of Britain, Germany, Holland, and the EC. These four speakers plunged ahead with their versions of horrendously expensive (to consumers) partial solutions to a problem which — even in Europe — is more political than it is physical. None of them understood the costs of their proposals.

Thank you for using your considerable prestige and luminous pen in the service of reason.

— JUDD ALEXANDER
Windermere, Fla.

WHO DECIDES WHAT YOU KNOW?

November/December 1993

IN YOUR RECENT EDITORIAL YOU DESCRIBED a "green-leaning editor who questions Bill Rathje's motivations, and thus called him 'the much-discredited Dr. Rathje'" — no explanation or attribution."

First, you should have attributed the quote to me. I stand by it.

Second, I am not "green-leaning." I'm green throughout. Always will be.

Further, my magazine previously published a summary of the technical and analytical errors in the research of Dr. William Rathje of the University of Arizona. I'll be glad to provide this summary to any GARBAGE reader who contacts me.

— JERRY POWELL
Editor-in-Chief, Resource Recycling
P.O. Box 10540
Portland, Oregon 97210

C'MON, WHEN YOU STARTED PUBLISHING GARBAGE, you must have known that your good intentions to teach us all something of the truth regarding the environment would lead to an attack on you by the "shriek-letter writers." My purpose in writing is merely to encourage you to take heart, we're listening out here, never mind the "pseudo-environmentalists" — lately arrived to save us all. Lenin said a

capitalist is someone who would sell you the rope to hang him with. This also describes a pseudo-environmentalist ... never interested in the solution, preferring to point out that "there is a hole in your end of the lifeboat." They're everywhere. You'll only be able to explain it to them, you can't understand it for them. My subscription order follows.

— F.W. PARKER
Ardmore, Okla.

JUST WANTED TO SAY WHAT A PLEASURE it is to see your "against the grain" reporting in recent issues. Stick to the facts; that's what it's about and you're to be commended for following that journalistic principle.

— PETER SPENCER
Editor, Consumers Research
Washington, D.C.





Champion Is No Hero

ATREE STUMP IS A BY-PRODUCT OF people making a living, of getting the wood out and whacking it into studs and cardboard boxes and toilet paper. Timber companies once "got the wood out" at a sustainable pace, allowing the forests to recover before the chainsaws moved in again. But starting in the early 1980s, that all changed on timber company land in Montana.

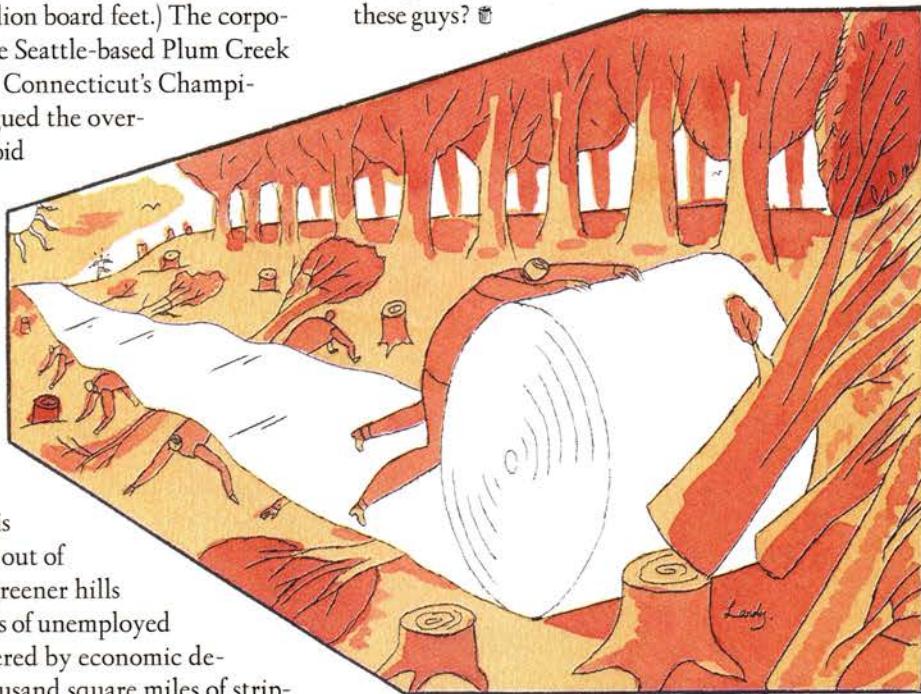
According to a recent study by the University of Montana's School of Forestry, over the past decade the timber giants logged their Montana lands at a rate nearly three times faster than the trees could grow back. Their tree-cutting binge reached unprecedented heights in 1986, when more than 700 million board feet of timber was "harvested" from Montana's industrial forests. (In 1980, they cut 466 million board feet.) The corporate loggers, principally the Seattle-based Plum Creek Timber Co. and Stamford, Connecticut's Champion International Corp., argued the over-cutting was necessary to avoid closing mills and to save thousands of jobs. But the University of Montana report reveals the '80s was a period of decreasing employment, mostly because of increased automation in the mills.

Loggers are getting the axe once again. This past fall, Champion pulled out of Montana and headed for greener hills in the South, leaving scores of unemployed workers, mill towns sundered by economic despair, and more than a thousand square miles of strip-

mined forests. One other outcome to Champion's cut-and-run: It made unlikely allies out of some enviros and loggers. (Champion sold all 867,000 acres of its Montana land to Plum Creek, which will attempt to re-plant the steep, rocky terrain.)

It wasn't the tree squeezers and onerous regulations that ran Champion out of town. Like many environmental issues, the bottom line in all of this is the bottom line.

In his book *Last Stand* (Gibbs Smith, 1991), journalist Richard Manning provides an inside glimpse of Champion's decision-making from Jim Runyon, a forester and company spokesman. Runyon told Manning that depressed timber prices pushed Champion's executives to decide "for strictly competitive reasons" to cut all of their Montana lands. The company's strategy, writes Manning, was "based on a cold calculation that once its trees were gone, Champion could use its economic clout to pry loose a supply of logs from Forest Service lands." But Champion couldn't quite prevail. Now the trees are gone, and so are many jobs. Is there a Dumpster big enough for these guys? ☐



MISSION STATEMENT



GARBAGE is independently published and has no ties to any political movement, industry, membership group, or activist organization. Furthermore, the editors endeavor to present topics of environmental concern from a journalistic perspective, rather than an advocacy perspective.

The mission of the magazine is...
...to follow in the tradition of a journal — looking to expert sources, providing depth of coverage, introducing the affiliations of all writers, offering analysis and perspective, and soliciting counterpoints.

...to predict and then research the important stories and controversies.
...to allow for skepticism (on all points of view), but with insight and a dose of humor.

...to allow science to speak, and allow policy to speak — and endeavor to explain which is which.

Finally, **GARBAGE** provides a forum where sometimes discordant groups — scientists, industry leaders, environmentalists, journalists, and public servants — may speak on the record before a diverse readership. Through presentation of a range of topics and opinions, the editors try to speak to the intrinsically human needs that gave rise to the modern environmental movement, while not ignoring science, while not discounting history, and while paying heed to risk assessment, prioritization, and economics.

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Ss

Seattle stomp, noun — The practice of compacting a week's worth of trash into a single bin. "You climb in, jump around, and eventually it all fits in one can," was how one Seattle resident described the Stomp for a *Wall Street Journal* reporter.

Not limited to Seattle, look for people buck dancing atop their trash in any city with "variable rate garbage fees." That is, cities where the amount residents pay to have their refuse hauled away varies according to the number of cans (or bags) they leave at curbside. Here in Gloucester, Mass., we pay \$1 a bag.

Seattle was the nation's first city to use variable rates. In 1989, the city's garbage oracles reasoned that if you charge by the volume of trash that's generated and eliminate fees for recycling-collection services, residents will have an economic (instead of a purely altruistic) incentive to cut waste and sort for recycling.

The Stomp came into vogue when folks figured some fancy footwork on their weekly refuse heap could save them the cost of an extra bag. Like a dance craze sweeping the land, over 1,000 communities nationwide now have systems based on the variable-rate concept. Some cities have even figured how to make their systems Stomp resistant: Charge by weight instead of volume.

The Seattle Stomp's exact origin remains a mystery. The earliest citation in the written record comes from garbage luminary N.C. Vasuki, executive officer of the Delaware Solid Waste Authority, who mentions the Stomp in a 1990 report published by Business News Inc. Mr. Vasuki credits the good people of Seattle in general with coining the phrase and says of the stompers, "They didn't end up with less trash — just less air in their trash."

An inquiry to the Seattle Solid Waste Authority brought a faxed reply from spokeswoman Ginny Stevenson. She points out that in cases of severe stomping, city garbage men can refuse to collect cans that are too heavy. As to the Stomp's origin: "Folks here say the term has been around for a number of years," she wrote. "And no one knows where it came from."

